REMARKS

Claims 59-75 remain in this application. Claims 59, 65, 68, 69 and 75 had been previously amended. No claims are cancelled.

Applicants thank Examiner Crosland for the cordial interview granted Applicants' undersigned attorney and corporate counsel from Harris Corporation, Michael Yatsko, and the inventor, James Ziarno.

At the interview, Applicants submitted an ARINC Flight Data Acquisition and Recording System specification (The 717 Document) prepared by the Airline Electronic Engineering Committee and published by Aeronautical Radio, Inc. (ARINC) (attached as Exhibit 1), and a PowerPoint chart showing key differences between U.S. Patent No. 5,351,194 to Ross et al. (hereinafter "Ross") and the copied claims of U.S. Patent No. 6,181,990 to Grabowsky et al. (hereinafter "Grabowsky") (attached hereto as Exhibit 2).

The claims now pending in this application are the claims previously copied and amended to include the recitations added during the reexamination of Grabowsky.

For purposes of clarity, a brief explanation of the procedural history of this application that was filed as an Amendment Under 37 CFR §1.607 to provoke an interference is set forth.

I. Previous Prosecution History

Applicants had filed the previous Amendment Under 37 CFR §1.607 on April 20, 2006 with existing claims 59-75 that had been added and copied verbatim from Grabowsky for purposes of provoking an interference with that patent. The U.S. Patent and Trademark Office had considered those amended claims patentable during reexamination of the Grabowsky

patent, originally filed on August 12, 2003 as application control no. 90/006,742.

In an Office Action dated August 9, 2002, the Examiner had rejected the originally copied claims from Grabowsky as being unpatentable, and thus, an interference could not be initiated since a prerequisite for interference under 37 CFR §1.606 is that the claim be patentable to the applicant subject to a judgment in the interference. Original claims 59, 62-70 and 75 were rejected as anticipated by Ross, and other claims as obvious over U.S. Patent No. 5,351,194 to Ross et al. (hereinafter "Ross") in view of U.S. Patent No. 5,652,717 to Miller et al. (hereinafter "Miller '717"), U.S. Patent No. 5,943,399 to Bannister et al. (hereinafter "Bannister"), or Ross in view of U.S. Patent No. 5,463,656 to Polivka et al. (hereinafter "Polivka").

A request for reexamination of Grabowsky was filed on August 12, 2003 as application control no. 90/006,742. During the reexamination, the patent owner amended independent claims to overcome the rejections over the cited prior art. In the reasons for patentability/confirmation mailed October 3, 2005, the Examiner stated that claims 1-51 of Grabowsky are patentable over the prior art of record. According to the Examiner, as argued by the patent owner, the art of record failed to teach an aircraft data transmission system and method comprising, among other limitations, at least one first sensor on the aircraft which gathers in-flight data and at least one second sensor configured to sensing a landing of the aircraft, wherein communication is initiated via a cellular infrastructure in response to the second sensor sensing the landing of the aircraft.

Applicants amended claims 59, 65, 68, 69 and 75 in the manner as allowed in the reexamination of Grabowksy in the

last Amendment filed on April 20, 2006. Applicants' disclosure specifically recites a plurality of transducers as set forth in the claim chart submitted in the Remarks section of that Amendment, corresponding to at least first and second sensors.

Grabowsky had also amended the independent claims to include the recitation that the flight data includes time, airspeed, altitude, vertical acceleration, and heading data relating to a flight of the aircraft. Those flight data parameters were included in Applicants' claims filed in the Amendment on April 20, 2006. In that last Amendment, Applicants submitted Federal Aviation Administration Section 121-343 (1994), which mandates that large airplanes certified for operation above 25,000 feet, or turbine-engine powered, must be equipped with one or more approved flight recorders that record data relating to time, altitude, airspeed, vertical acceleration and heading. Other flight data are also recorded as set forth in the regulation. As noted by Applicants in their remarks, any flight data acquired by the DFDAU and DFDR includes this data. These parameters are directly from the FAA requirements for "black boxes," i.e., the flight data recorders.

In the last Office Action dated July 24, 2006, the Examiner stated that an interference could not be provoked because: (1) the claims contained new matter directed to the inclusion of the flight parameters: "wherein said flight data includes time, air speed, altitude, vertical acceleration, and heading data relating to flight of the aircraft;" and (2) the claims were not patentable to Applicants.

II. The New Matter Rejection

During the interview, it was emphasized that the original application identified above specifically recited that the flight performance data generated by the DFDAU and supplied to the aircraft's flight data recorder was a compressed copy of the flight data recited in the 717 document. As stated in the Summary of the Invention section of the instant application:

> "A principle function of the GDL unit is to store a compressed copy of the (ARINC 717) flight performance data generated by the DFDAU and supplied to the aircraft's flight data recorder."

The 717 document includes many other flight data parameters besides the listed time, air speed, altitude, vertical acceleration and heading data relating to a flight of the aircraft. The claimed parameters, however, are those parameters set forth as required under FAA guideline Section 121.343 (previously submitted) for flight recorders.

As discussed at the interview, one skilled in the art understands that any "black box" and DFDAU system gathers data relating to time, air speed, altitude, vertical acceleration, and heading data. These are minimum flight data parameters that are required to be sensed, gathered and stored throughout the flight of an aircraft by the DFDAU and supplied to the aircraft's flight data recorder. Claim 1 as previously amended and copied from Grabowsky included these essential flight data parameters required under FAA regulations and set forth in the 717 document.

Therefore, the recitation of the flight data including time, air speed, altitude, vertical acceleration and

heading data relating to a flight of the aircraft are required parameters that are included as part of the compressed copy of the flight performance data generated by the DFDAU and gathered and stored in-flight as part of any aircraft system that follows the FAA guidelines and ARINC standards set forth in the 717 document.

The 717 document submitted as Exhibit 1 was published on April 1, 1998. The third page has the history as adopted by the Airline Electronic Engineering Committee. The earliest date is December 8, 1978 as reflected on that sheet. The 717 document indicates that the required, minimum parameters of time, air speed, altitude, vertical acceleration and heading data relating to a flight of the aircraft are required parameters that antedate the November 14, 1995 filing date of the original application from which this continuation application is based and the filing date of Grabowsky on July 30, 1998. During the interview, a copy of the 717 document was given to the Examiner with the pertinent sections setting forth these parameters tagged for easy location by the Examiner. Time (GMT) is shown at Attachment 6, ARINC 429 DITS Port 7 at page 50. Air speed is shown at Section 4.3.1 Labeled Aircraft Data on page 12. Radio Altimeter (Altitude) is shown at Attachment 6 ARINC 429 DITS Port 9 on page 50. Vertical Acceleration is shown at Attachment 5-2 on Page 45, as Analog Input No. 1. Heading is shown at ARINC 429 DITS Port 15 at Attachment 6 on page 50.

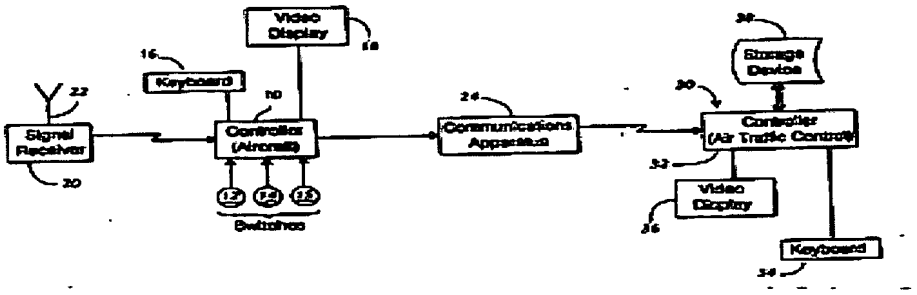
III. The Rejected Claims Based on Ross and Miller

In the Office Action dated July 24, 2006, the Examiner rejected claims 59, 62-70 and 75 as unpatentable over Ross in view of U.S. Patent No. 4,729,102 to Miller, Jr. et al. (hereinafter "Miller"), and other claims as unpatentable

over Ross in view of Miller, and further in view of Miller '717, or Ross and Miller in view of Bannister, or Ross and Miller in view of Polivka.

During the interview, the PowerPoint chart showing the key differences between Ross and Grabowsky as covered by the copied claims was set forth and is enclosed as Exhibit 2. As discussed at the interview, Ross is directed to cancelling a flight plan of an aircraft to facilitate release of the Instrument Flight Rules (IFR) air space to other aircraft, and communicating the location of a downed aircraft during emergencies.

The basic system shown in FIG. 1 of Ross is set forth below.



As shown in FIG. 1 reproduced above, Ross has a controller 10, such as a TravelMate 4000 Texas Instrument notebook computer, which communicates with a communications unit 24 as a cellular telephone in a preferred embodiment. The controller includes a video display 18 and keyboard 16. Before take-off, a pilot enters a flight plan into the controller 10 using the keyboard 16 and display 18. A signal receiver 20 and antenna 22 receive GPS signals and transmits them to the controller 10. The GPS signals provide position data to the controller 10. These position signals can be communicated by the communications unit 24 as a cellular telephone signal. In an alternate embodiment, the controller

10 communicates with the cockpit instruments in the aircraft and receives from the cockpit instrumentation data relating to the altitude, air speed and direction of the aircraft. The controller can transmit this data to an air traffic control 30 via the communications unit 24 (cellular telephone).

Three switches 12, 14 and 15 are connected to the controller 10. Switch 12 is a high impact emergency switch that is activated automatically upon a crash landing of the aircraft. At that time, position data from the GPS and the identification of the aircraft is transmitted as explained in column 6 starting at line 23 through line 36.

Switch 15 is a manual switch that is activated by the pilot "in-flight" when an in-air emergency occurs. At that time, the position information and any flight plan entered by the pilot is communicated through the communications apparatus 24 as real-time, instantaneous data that is transmitted in-flight. At the same time, the altitude, air speed and direction of the aircraft at that particular time in the air as received from the cockpit instrumentation can be communicated. Thus, when the emergency switch 15 is activated in the air, (1) position data from the GPS, (2) cockpit instrumentation data, and (3) the flight plan are transmitted as real-time data for the instant in time when the pilot activates the switch 15.

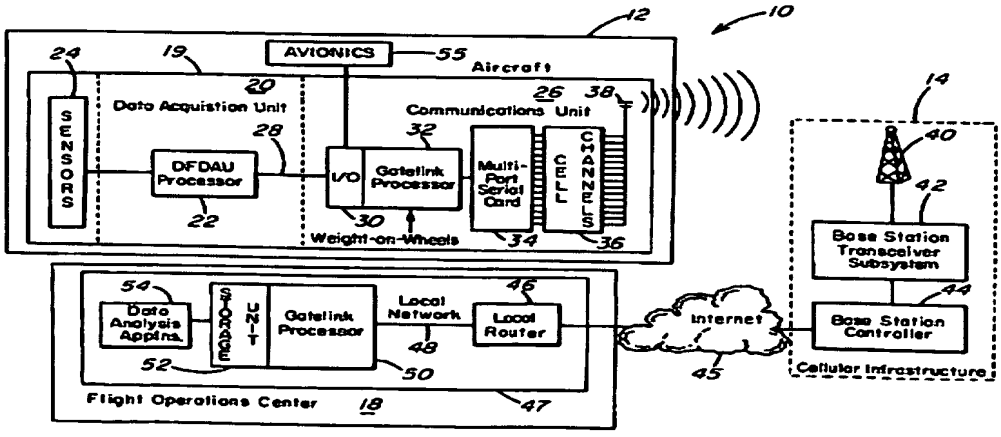
During a normal landing, switch 14 is activated either manually or automatically. At that time, the flight plan is cancelled. Position data is not transmitted during a normal landing because the position is already known (the aircraft has safely landed at its destination). The only requirement is to cancel the flight plan.

This information is set forth in the PowerPoint sheet submitted as Exhibit 2. Ross is directed to

transmitting real-time position data at one time during a flight (an emergency). The only data transmitted is tracking and locating information that is based upon the instantaneous data received from the GPS, the aircraft instrumentation, and the previously input flight plan. If a crash occurs, the aircraft sends data relating to the aircraft location and ID. If a normal landing occurs, the flight plan is cancelled and the only data would be a short data packet that cancels the flight plan.

The copied claims from Grabowsky, on the other hand, are directed to an aircraft flight data acquisition and transmission system in which in-flight data from the DFDAU is stored throughout the flight of the aircraft as discussed at the interview. After the aircraft lands, this stored data that has been gathered in-flight is transmitted as a ground transmission. The flight data gathered in-flight, stored throughout the flight, and transmitted after landing includes the time, air speed, altitude, vertical acceleration and heading.

The system from Grabowsky and covered by the copied claims (FIG. 2 of Grabowksy) is reproduced below.



The Grabowsky system includes sensors 24 that gather different in-flight parameters, such as the time, air speed, altitude, vertical acceleration and heading data, relating to the flight of the aircraft. This data is gathered during the entire aircraft flight and stored in the data acquisition unit 20, which includes the DFDAU processor 22. Upon the aircraft's landing, such as sensed by the illustrated weight-on-wheels mechanism, the system downloads this gathered and stored data.

Grabowsky teaches opposite from Ross because Ross is directed to transmitting real-time data during a flight (not after landing). This real-time data relates to the aircraft position and the flight plan and is transmitted when the pilot pushes the emergency switch 15. If a crash occurs and the high impact emergency switch 12 is activated, only the location and ID of the aircraft is transmitted. If an aircraft lands and switch 14 of Ross is activated, only data relating to cancellation of the flight plan is transmitted.

The Examiner cites Miller and argues that Miller teaches vertical acceleration as one of the data parameters that can be transmitted. As discussed at the interview, Miller is directed to an aircraft data acquisition and recording system where either:

(a) an RF transmitter transmits data while the aircraft is in flight, in which snapshots of the monitored parameters of the flight performance at the instant the transmission is initiated are transmitted to ground stations (Miller, column 8, lines 25-50; column 19, lines 49-58); or

(b) aircraft maintenance personnel must bring a portable ground read-out unit 30 on board the aircraft after it has parked, in which case data indicative of the performance of significant portions of the flight is obtained

(Miller, FIG. 1 and column 13, line 26 through column 14, line 25).

At most, the combination of Ross and Miller would suggest a scenario in which the aircraft pilot activates emergency switch 15 to transmit: (1) GPS position; (2) the recorded flight plan as entered by the pilot initially before take-off; (3) the instrumentation data taken from the instrument cockpit equipment relating to altitude, air speed and direction of the aircraft; and (4) the additional DFDAU data as a snapshot in real-time as suggested by Miller.

This data is transmitted in real-time while the aircraft is in flight. That data is not gathered and stored in-flight as taught and claimed by Grabowsky.

During the interview, a discussion was held regarding any long-term accumulation in Miller. Miller can accumulate long-term over the flight of the aircraft, but when the aircraft lands, there is no downloading of data. Instead, airport personnel must physically enter the plane and retrieve the data by inserting a disk.

Thus, the combination of Ross and Miller when an aircraft lands would suggest that the only data transmitted automatically would be the cancellation of flight plan, while aircraft personnel would manually enter the plane to retrieve the additional data via a disk.

IV. Rejection Over Ross, Miller and Other Art

The other prior art references cited by the Examiner are further removed. Without going into undue detail, it is noted that Miller '717 is directed to collecting, analyzing and presenting geographical information that can be stored for later use. This information relates to data obtained from satellites, recognizance aircraft, photographs, maps, remote

computer terminals and the like, and integrated into a generic Geographic Information System (GIS). This data can be manipulated by a user. Miller may show the acquisition of some data from an aircraft and some use of a telecommunication network with internet connection, but Miller does not suggest the claimed invention for gathering and storing in-flight data that includes time, air speed, altitude, vertical acceleration and heading data relating to a flight of the aircraft and then downloading the data after the aircraft has landed.

Bannister shows a combination of a public switched telephone network (PSTN) and the internet. Bannister does not suggest the claimed invention in combination with the other cited prior art references. Bannister is specifically directed to a GSM and SMS system operative with an Interactive Voice Response (IVR) system allowing callers to send short messages to mobile terminals that use workstations to send short messages. Bannister is directed to the problem of avoiding the disadvantages known with Short Message Services where the caller may not have access to a workstation.

Polivka is directed to the aircraft industry and shows an aircraft data acquisition and transmission system that can acquire data through a video camera and encrypt and segment packets of data. It may provide some acknowledgment of data, but it is specifically directed to reducing the size of an aircraft antenna required to provide full broadcast quality video communications with an aircraft that communicates to the satellite communications link. Polivka teaches polarizing a receiver array to align with that of an incoming beam from the relay satellite by an error signal feedback path to control steering weights of the array. Thus, the size of the antenna can be reduced to increase the

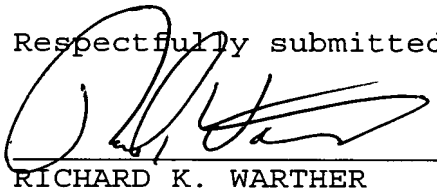
satellite-linked broadcast quality video communications with an aircraft.

It is clear that none of these cited references singularly or in combination with the other Ross and Miller patents disclose or suggest the invention of the claims copied from Grabowsky.

Applicants submit that the present case is in condition for allowance and respectfully requests that the Examiner provoke an interference.

If the Examiner has any questions, the undersigned attorney would appreciate a telephone call.

Respectfully submitted,



RICHARD K. WARTHER
Reg. No. 32,180
Allen, Dyer, Doppelt, Milbrath
& Gilchrist, P.A.
255 S. Orange Avenue, Suite 1401
Post Office Box 3791
Orlando, Florida 32802
Phone: 407-841-2330

ARINC

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

ARINC CHARACTERISTIC 717-10

PUBLISHED: APRIL 1, 1998

AN ARINC DOCUMENT
Prepared by
AIRLINES ELECTRONIC ENGINEERING COMMITTEE
Published by
AERONAUTICAL RADIO, INC.
2551 RIVA ROAD, ANNAPOLIS, MARYLAND 21401

EXHIBIT 1

ARINC CHARACTERISTIC 717-10
FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: April 1, 1998

Prepared by the Airlines Electronic Engineering Committee

Characteristic 717	Adopted by the Airlines Electronic Engineering Committee:	December 8, 1978
Characteristic 717	Adopted by the Industry:	February 28, 1978
Characteristic 717-1	Adopted by the Airlines Electronic Engineering Committee:	August 30, 1979
Characteristic 717-2	Adopted by the Airlines Electronic Engineering Committee:	June 18, 1980
Characteristic 717-3	Adopted by the Airlines Electronic Engineering Committee:	March 13, 1981
Characteristic 717-4	Adopted by the Airlines Electronic Engineering Committee:	December 10, 1981
Characteristic 717-5	Adopted by the Airlines Electronic Engineering Committee:	August 15, 1985
Characteristic 717-6	Adopted by the Airlines Electronic Engineering Committee:	November 8, 1985
Characteristic 717-7	Adopted by the Airlines Electronic Engineering Committee:	August 19, 1986
Characteristic 717-8	Adopted by the Airlines Electronic Engineering Committee:	January 6, 1988
Characteristic 717-9	Adopted by the Airlines Electronic Engineering Committee:	August 20, 1993
Characteristic 717-10	Adopted by the Airlines Electronic Engineering Committee:	October 24, 1996

FOREWORD

Activities of AERONAUTICAL RADIO, INC. (ARINC)

and the

Purpose of ARINC Characteristics

Aeronautical Radio, Inc. is a corporation in which the United States scheduled airlines are the principal stockholders. Other stockholders include a variety of other air transport companies, aircraft manufacturers and non-U.S. airlines.

Activities of ARINC include the operation of an extensive system of domestic and overseas aeronautical land radio stations, the fulfillment of systems requirements to accomplish ground and airborne compatibility, the allocation and assignment of frequencies to meet those needs, the coordination incident to standard airborne communications and electronics systems and the exchange of technical information. ARINC sponsors the Airlines Electronic Engineering Committee (AEEC), composed of airlines technical personnel. The AEEC formulates standards for electronic equipment and systems for the airlines. The establishment of Equipment Characteristics is a principal functions of this Committee.

An ARINC Equipment Characteristic is finalized after investigation and coordination with the airlines who have a requirement or anticipate a requirement, with other aircraft operators, with the Military services having similar requirements, and with the equipment manufacturers. It is released as an ARINC Equipment Characteristic only when the interested airline companies are in general agreement. Such a release does not commit any airline or ARINC to purchase equipment so described nor does it establish or indicate recognition of the existence of an operational requirement for such equipment, nor does it constitute endorsement of any manufacturer's product designed or built to meet the Characteristic. An ARINC Characteristic has twofold purpose, which is:

(1) To indicate to the prospective manufacturers of airline electronic equipment the considered opinion of the airline technical people, coordinated on an industry basis, concerning requisites of new equipment, and

(2) To channel new equipment designs in a direction which can result in the maximum possible standardization of those physical and electrical characteristics which influence interchangeability of equipment without seriously hampering engineering initiative.

ARINC CHARACTERISTIC 717
TABLE OF CONTENTS

ARINC CHARACTERISTIC 717
TABLE OF CONTENTS

ARINC CHARACTERISTIC 717
TABLE OF CONTENTS

ARINC CHARACTERISTIC 717
TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Purpose of This Document

This document provides design guidance for the development and installation of a Digital Expandable Flight Data Acquisition and Recording System (DEFDARS) primarily intended for airline use. As such, this guidance will include specific requirements necessary to accommodate mandatory flight data recording and other flight data acquisition needs plus the requirements to ensure customer controlled interchangeability of equipment in a standard aircraft installation.

1.2 Basic Principles

The objective of this Characteristic is primarily to describe equipment and installation standards capable of meeting the mandatory flight data recording requirements of the FAA and other regulatory bodies and secondarily to describe certain features to provide the flexibility and the expansion capability needed to implement a version of an Aircraft Integrated Data System (AIDS) or other special purpose data acquisition system.

1.2.1 Relationship to ARINC Characteristic 573

ARINC Characteristic 573, which was first developed to meet the requirements for expanded flight data recording of 1973, described an acquisition system with mainly analog inputs reflecting the equipment and the technology in use at that time.

With the work of the AEEC Systems Architecture and Interfaces (SAI) Subcommittee, digital technology was applied to practically all equipment in aircraft introduced in the early 1980's and after. This decision, the acceptance of the digital signal standard of ARINC 429, and the new packaging concepts of ARINC 600, made the ARINC 573 acquisition unit obsolete in a new technology aircraft. Thus the decision was made to develop a "second generation ARINC 573" system to take its place in future aircraft.

¢-9

To preserve the good properties of the ARINC 573 system and to protect the considerable investment in data readout and system test equipment, many features of the ARINC 573 system have been retained. This Characteristic retains the ARINC 573 Flight Recorder and Accelerometer, and thus makes them part of the system defined herein. Because of its direct functional dependence on the acquisition unit, the Data Entry Panel is redefined by this Characteristic.

1.2.2 Relationship to ARINC 429

Digital input signal requirements for the DEFDARS system should conform to the standards of ARINC 429 at the low speed or the high speed bit rate.

The requirement that the acquisition unit defined by this Characteristic be compatible with the ARINC 573 recorder makes it impossible to use the ARINC 429 format for the acquisition unit flight recorder output.

1.3 System Functions

1.3.1 Minimum System

DEFDARS, when configured to meet the mandatory flight data recording requirements, should, as a minimum, acquire and record the mandatory parameters as received from aircraft system and from the DEFDARS accelerometer.

The DEFDARS recorder should meet all applicable regulatory agency specifications for data retention, crash survival, etc.

An optional cockpit data entry panel may be used to enter for instance, flight identification data. As a minimum, there should be a control panel mounted in the cockpit to provide the necessary switches and lights for preflight tests and system checks. This panel is not by itself part of this Characteristic since its for and functions are dependent on each particular aircraft and on national requirements. The standard interwiring allows the use of the data entry panel, the control panel or both.

1.3.2 Expanded System

The minimum DEFDARS may be combined with other units to form a specialized data acquisition and recording system. This expanded system may for instance include more than one acquisition unit, remote acquisition units, a computer or other unit for system control and data management, a quick access recorder, expanded data display/entry panel, etc.

The expanded system is not part of this Characteristic except that the interfaces with the DEFDARS acquisition unit-which is part of the minimum system - are specified in as much detail as necessary to insure integrity of mandatory flight recording in an expanded system.

1.3.3 System Inputs

The DEFDARS acquisition unit should accept the following signal types:

- Digital, ARINC 429 (DITS)
- DC Voltage Amplitude and Ratio
- Potentiometer (DEFDARS excited)
- AC Voltage Ratios
- Synchro, ARINC 407
- Temperature Probe (DEFDARS excited)
- Switch Discretes

This list should cover all signals required for mandatory recording. In an expanded DEFDARS there may be a need to accommodate other signal types as specified for each application using optional circuitry in the acquisition unit or using optional units.

1.0 INTRODUCTION (cont'd)

1.4 Unit Functions

1.4.1 Digital Flight Acquisition Unit (DFAU)

The Digital Flight Data Acquisition Unit (DFDAU) contains the circuitry necessary for the acquisition, conditioning and conversion of sensor signals of interest to the user. It is expected that the DFDAU functions are processor controlled.

Sampling sequence of the flight data parameters is determined by a read-only-memory (ROM) which is specified for each application by the user. This ROM completely controls all signal programming as to input pin assignments, type of signal and data frame assignment.

Two digital data output circuits are specified to be provided from the Digital Flight Data Acquisition Unit. Each of the two specified outputs should consist of serial twelve - bit words, always with the least significant bit (LSB) transmitted first and with a data rate and modulation as follows:

FLIGHT RECORDER OUTPUT - Data rate of 64 words per second formatted into a frame of four subframes of 64 words each. Electrical format should be Harvard Bi-Phase modulation.

¢-1 AUXILIARY OUTPUT - Data format specified be user and the electrical format should be Bi-Polar modulation.

COMMENTARY

In an expanded system or in a system intended for engineering test, a cassette type quick access recorder may be installed with the data processed separately from flight recorder data. A separate auxiliary output ensures that this extra recorder does not compromise the critical flight recording.

In addition to these outputs, there are pins set aside for an optional high-speed output for possible use in an expanded system.

The detailed characteristics of the DFDAU are shown in Section 5.

1.4.2 Digital Flight Data Recorder (DFDR)

The Digital Flight Data Recorder (DFDR) should provide a minimum recording capability of 25 hours duration accepting digital data from the 64 words per second Flight Recorder Output of the DFDAU.

Circuitry necessary to determine status of the DFDR should be provided to meet applicable dispatch requirements. The DFDR should be crash-protected to meet FAA Technical Service Order (TSO) C-51A or other applicable minimum standard.

The detailed characteristics of the DFDR are shown in Section 6.

1.4.3 Accelerometer

The standard accelerometer should be an instrument sensitive in all three axes as shown in Section 7.

1.4.4 Flight Data Entry Panel (FDEP - Optional)

The optional Flight Data Entry Panel, when used, should provide a means for manual entry of documentary data and, at the manufacturer's option, for data display and for system test, control, and fault isolation. The interface with the DFDAU should be determined by the manufacturer.

The detailed characteristic of the FDEP are shown in shown in Section 8.

1.4.5 Printer (Optional)

A hard-copy printer to be used in conjunction with the DFDAU is an optional item. Pins have been reserved on the DFDAU connector to provide the interface connections needed for the printer. ¢-1

COMMENTARY

Details for the printer are no given in this Characteristic, however, there has been interest in having a "standard" printer that may operate with various types of equipment (i.e., ACARS). It is the hope of the developers of ARINC 717 that the manufacturers of DEFDARS equipment will provided a printer interface (when requested) that will operate with such a "standard" printer.

Some earlier versions of the DEFDARS provided an interface compatible with the printer defined in ARINC Characteristic 597. Since then, ARINC Characteristic 740 describing a multiple input printer was adopted. Additional pins have been reserved to accommodate this printer. ¢-7

1.5 Reliability and Maintainability

1.5.1 Reliability

The anticipated operational use of the DEFDARS demands the utmost attention to the need for reliability in all phases of design, production, installation and operation of the equipment.

COMMENTARY

The designer may be surprised to find no elaborate requirements for reliability. The airlines are in a most fortunate position in this regard because they have found the pressures of the "marketplace" exert a truly meaningful influence upon the design and production quality control necessary to achieve high equipment reliability. The key advantage enjoyed by the vast majority of airlines is the ability to purchase existing, fully operational equipment "off the shelf" after the product has established itself in the market. Reduced to the simplest of terms, the manufacturer will find that if he does not design it and build it properly, it won't sell!

1.0 INTRODUCTION (cont'd)

1.6 Interchangeability

"Unit Interchangeability" is required for the Digital Flight Data Recorder and standard accelerometer regardless of the manufacturing source. The detailed requirements intended to ensure satisfactory interchangeability are shown in Section 2.0, "Interchangeability Standards."

The basic DFDAU specified by the Characteristic should be electrically and mechanically interchangeable between manufacturers. Since the processor ROM, which programs input pins and signal types and assigns all word slots, is customer specified, there is, however, no guarantee for functional interchangeability between installations.

If the recommended input assignments of Attachments 5 and 6 are followed, there may be complete interchangeability for mandatory purposes between units of different airlines and different manufacturers. This is true at least for a certain type of aircraft or family of aircraft using the same data source systems and operating under the same regulation.

COMMENTARY

The Subcommittee producing this Characteristic struggled very hard trying to define the DFDAU so that complete unit interchangeability, as successfully specified for the ARINC 573 FDAU, could be maintained.

It was possible to provide the analog data flexibility required to meet the widely varying regulatory requirements and the individual airline desires for the use of the non-mandatory word slots. It was not, however, possible to meet those requirements for the label arrangements of the ARINC 429 ports. When it became obvious that everybody's DFDAU would have to be compromised (read-more expensive) due to other user's needs, and when several airlines began asking what a simple DFDAU just for their needs would cost, the Subcommittee decided instead to define the base that everybody needed.

¢-9

The basic DFDAU hardware therefore has a sufficient number of analog, digital and discrete inputs to satisfy everybody. It also has the signal conditioners most useful in modern aircraft and certain other features needed by all users. The frame structures of this Characteristic and ARINC 573 are identical (Four 64-word subframes using the same data synchronization method). The detailed frame word assignments are to be specified by the user. This was the only way to achieve the necessary flexibility dictated by the real and anticipated differences in aircraft systems and in regulatory and company requirements.

NOTES:

1. The standards for interchangeability between DFDAUs with different part numbers will only apply to electrical and mechanical characteristics of the basic unit as required for mandatory flight data recording.

2. In addition to the above interchangeability standards, all of the optional units of the system should be fully interchangeable with other such units produced by the same manufacturer and should not require any flight line adjustment or calibration.

3. The above need for "Unit Interchangeability" of the Accelerometer and DFDR units makes it necessary to fully define a standard electrical interface for these two units. ¢-9

COMMENTARY

The development of interchangeable equipment for the airline industry has been the keystone of AEEC standards for over four decades. Today the airline industry considers the interchangeability aspects of airborne equipment to be by far the most important advantage of the development of an ARINC Equipment Characteristic. Thus, if an Equipment Characteristic fails to establish interchangeability of units between manufacturers, it has not fulfilled its intended purpose. Set manufacturers must, therefore, realize the extreme importance which the airlines industry places on interchangeability. True, interchangeability may tend to limit an individual manufacturer's initiative; however, the airline industry has chosen to accept this disadvantage in exchange for interchangeability which nets a large return through time and money saved in implementing new systems in the airline fleets. The primary reason for the interchangeability requirements is to provide the customer with several freedoms.

1.7 Regulatory Approval

The equipment should meet all applicable regulatory requirements for Flight Data Recorders. In the absence of a current TSO for the DEFDARS, direct regulatory approval cannot be obtained. The installation will normally be approved as part of the original equipment on the aircraft or by a Supplemental Type Certificate. The equipment manufacturer should refer to current TSOs for typical environmental requirements. ¢-9

1.0 INTRODUCTION (cont'd)

1.7 Regulatory Approval (cont'd)

COMMENTARY

The airlines and manufacturers have consistently emphasized the benefits to be derived from the resolution of past differences between the regulatory requirements of various governments. Now the increased reliability and better manufacturing quality control associated with a fully standardized installation is recognized by the US FAA and its counterparts in other governments.

NOTE: Manufacturers are cautioned to seek out and observe any unique regulatory requirements applicable to their customers' equipment. One example is the French SGAC requirement for a secondary retention tethering means for the DFDR now shown in Attachment 3-3 but unknown at the writing of ARINC 573.

2.0 INTERCHANGEABILITY STANDARDS

2.1 Importance of Interchangeability

It is of prime importance that the industry establish specific form factors, mounting provisions, interwiring, output signal data and power supply standards for the AIDS system. The establishment of airframe installation standards cannot await the completion of new equipment developments by the manufacturers. Because of the very extensive potential cost saving involved, advanced planning on the part of the airline customers has always been necessary and is particularly so with the many problems of adding AIDS equipment to present aircraft and planning future installations.

Manufacturers should note that although this Characteristic does not preclude the use of standards different from those set forth herein, the practical problems of redesigning what will then be a standard aircraft installation to accommodate some special installation could very well make the use of that other design prohibitively expensive for the potential customer. Therefore, manufacturers should recognize the practical advantage of developing equipment in accordance with the standard form factors and the standard interwiring shown in this document.

2.2 Form Factors and Connectors

ARINC 600 for the DFDAU, ARINC 404A for the DFDR, and ARINC 404A for the FDEP with all current Supplements must be followed in explicit detail to assure universal interchangeability between equipment of different manufacturers. The equipment manufacturer is cautioned that the equipment must conform to standards for dimensions, tolerances, type of hold-down, extractors, cooling provisions and limits on weight and center of gravity specified in those documents.

Units of the minimum system defined in Section 3.1 of this Characteristic should be interchangeable regardless of manufacturer, as specified in Section 1.6.

2.2.1 Digital Flight Data Acquisition Unit (DFDAU)

2.2.1.1 Form Factor

¢-9 The DFDAU should comply with the dimensional standards in ARINC Specification 600, "Air Transport Avionics Equipment Interfaces," for the 6 MCU form factor.

The DFDAU should be provided with a low insertion force, size 3 shell ARINC 600 service connector. This connector, which should accommodate aircraft interconnections in its top, center and bottom inserts should be located on the center grid of the equipment's rear panel. Index pin code 01 should be used. A second connector of the vendor's choice should be used for ATE connections. The configuration and location of the ATE connector should not interfere with normal aircraft installation.

Guidance on the ATE interface can be found in Section 9 of this document.

Top Inserts (TP) (2)	150x#22 signal contacts
Center Inserts (MP) (2)	150 x #22 signal contacts
Bottom Inserts (BP) (2)	2 x #5 contacts, 4 x #12 contacts, 3 x #16 contacts, 4 x #20 contacts

2.2.1.2 Cooling

The DFDAU should be designed to accept, and airframe manufacturers should configure the installation to provide, forced air cooling as defined in Section 3.5 of ARINC Specification 600. The standard installation should provide an airflow of 15.4 Kg/hr. of air having a maximum temperature of 40ºC. This rate of air flow is calculated on the basis of approximately 70 W of dissipated energy in the DFDAU. The pressure drop at the design flow rate from inlet to exhaust should be 25 ±5 mm of water under standard conditions (1013.25 mb). No internal blower should be used.

2.2.2 Digital Flight Data Recorder (DFDR)

The digital flight data recorder should be packaged in a full length 1/2 ATR case per ARINC 404A with M81659/35A2-0133 connector (Attachment 3-3). The unit hold-down hardware should conform to ARINC 404 Class A or C (thumb-screw) standards.

NOTE: For those users for whom the 1/2 ATR DFDR is unsuitable (perhaps because of different regulatory requirements than those assumed in choosing the industry standard configuration), the alternative of a free (pendant) connector to supply an unspecified DFDR is allowed. In which case, the Unit Interchangeability desired in Section 1.6 will no longer apply with respect to the DFDR. The connector type and pin connections are specified in the Note of Attachment 3-4.

2.2.3 Accelerometer

The physical characteristics of the accelerometer and its connector should conform to Attachment 3-5. The form factor applies primarily to mounting pattern and connector location. The case envelope dimensions are guides for maximum volume rather than specific shape.

2.2.4 Flight Data Entry Panel (FDEP)

The physical characteristics of the optional FDEP should conform to maximum volume limits and other standards in Attachment 3-7 with an MS3122E20-41P connector or equivalent and with standard quarter-turn panel mounting.

2.3 Input and Output Signal Characteristics

All inputs and outputs specified in Section 4 are needed to ensure electrical interchangeability.

2.0 INTERCHANGEABILITY STANDARDS (cont'd)

2.4 Standard Interwiring

The standard interwiring of Attachment 2 is the minimum unit-to-unit interwiring of any DEFDARS installation and is specified to ensure interchangeability for the minimum system.

2.5 Power Circuitry

2.5.1 Primary AC Power Input

The equipment should be designed to utilize 115 VAC/400 Hz single phase power per ARINC Report 413, "Guidance for Air-Transient Protection." The aircraft power supply characteristics, utilization equipment design limitations, and general guidance material are shown therein. The same power source should be used for the DFDAU, DFDR, and FDEP (where installed).

2.5.2 Power Interlocks and Power Control

Power to the various units of the DEFDARS should be interlocked by aircraft systems and controlled by the cockpit panel, so that at all times, the mandatory requirements for both data retention and pre-flight system checks are met.

This will require interlock connections to certain aircraft systems as determined by the airframe manufacturer. A power switch in the cockpit should allow for automatic turn-on and turn-off of the whole system by the interlocks. It should enable control of the whole system for pre-flight status check as required and in addition turn-on of the whole system except the DFDR for extended ground checks. Any switch positions turning on the DFDR should be either guarded or momentary. It should not be possible to turn the system off by manual control if it has been turned on by the interlocks. The switches should be rated at 2A/115 VAC/400 Hz.

2.5.3 Sensor Excitation

Outputs needed from the DFDAU for DC excitation of DEFDARS sensors are described in Section 4.4

2.6 Weights

The maximum weight of the unit should be as specified below:

Equipment Units	Weight (lbs)
Digital Flight Data Acq. Unit	20
Digital Flight Data Recorder	30

2.7 Environmental Specification

The DEFDARS equipment should be designed to meet the environmental specifications applicable to the installation limits as set forth in RTCA Document DO-160.

COMMENTARY

Sometimes an airframe manufacturer will issue his own environmental specifications which tend to be more lenient towards noise emission and more stringent towards noise susceptibility. An avionics manufacturer should therefore survey the specifications presently in use but the airframe manufacturer should realize that an airline expects to generally find DO-160 limits adequate and will put the blame on the airframe manufacturer if they are not. Of particular concern is a trend to overdesign the equipment to compensate for ambient levels in excess of those in DO-160.

2.8 Abnormal Conditions

2.8.1 Power Interrupts and Low Power Levels

For power interruptions of 10 milliseconds or less, there should be no break in operation of the DFDAU. For interruptions of 200 milliseconds or less but greater than 10 milliseconds the DFDAU should start at the next sync word following the word being processed at the time of the interruption. For interruptions of greater than 200 milliseconds, the DFDAU should reinitialize and return to the beginning of the frame. The DFDAU should continue to operate when the power source drops to a level as low as 80 volts. ¢-1

COMMENTARY

Although it is acceptable to lose a portion of the data following the interrupt, the users would like to retain time measurement during this period. It is desirable for the manufacturer to provide this capability during the power interrupt or low power condition.

2.8.2 Loss of Cooling

For loss of forced air cooling normally provided by the avionics rack, the DFDAU should operate within specification for 30 minutes.

COMMENTARY

For this condition it is assumed that the ambient air temperature in the avionics bay is 80°F and that no cooled air may be drawn from the cooling system aboard the aircraft.

3.0 SYSTEM DESIGN (cont'd)

3.1 General

The minimum DEFDARS installation for mandatory flight data recording consists of four units:

- The Digital Flight Data Acquisition Unit - (DFDAU)
- The Digital Flight Data Recorder - (DFDR)
- The Accelerometer
- A Control Panel

An optional Flight Data Entry Panel (FDEP) may be added as specified by the airline, in addition to or in place of the airframe designed control/test panel in the cockpit.

For an expanded system, additional DFDAUs and other acquisition, controlling or recording units may be added as specified by the airline. Expansion of the system must never compromise the integrity of the mandatory flight recording.

The system will output BITE information to provide functional test and troubleshooting capabilities.

3.2 System Interwiring

The system interwiring shown in Attachment 2 is required for all original installations, regardless of aircraft or unit manufacturer. It will ensure that there is wiring for proper interconnection of all the basic units, allowing all the flexibility of the basic design described in this Characteristic.

¢-1 There should be complete wiring between the DFDAU and a connector in the cockpit. This connector should be in the flight engineer's area and should in turn connect to the control panel and/or to the optional FDEP. The cockpit disconnect should be in a location to provide access with minimum effort.

3.3 Units

3.3.1 DFDAU

The DFDAU is the primary acquisition unit and should sample, condition and digitize or reformat the flight data. Its output is a serial digital bit stream ready to be recorded. The DFDAU also provides the system timing for the minimum DEFDARS.

To allow for system expansion, the DFDAU has an additional recorder compatible output, an unspecified high-speed output, remote acquisition unit inputs, timing control input/output and a set of undefined connections to be used at the manufacturer's and the system designer's option.

The DFDAU is specified in detail by the Characteristic.

3.3.2 DFDR

The DFDR is the flight recorder with the crash protected medium required by most countries on board large passenger-carrying aircraft.

The DFDR is specified in detail by the Characteristic.

3.3.3 Accelerometer

The accelerometer provides the acceleration information required for flight recording and is a primary source for DEFDARS.

The accelerometer is specified in detail -- except for exact size -- by this Characteristic.

3.3.4 Control Panel

The control panel should as a minimum provide the required system test and power control functions of Sections 2.5.2 and 3.10.1. The control panel functions may be added to another cockpit panel including FDEP, but should not be recognized that the pre-flight test functions may be required for dispatch while the FDEP is not.

The physical characteristics and the connectors are not specified.

3.3.5 FDEP

The optional FDEP may allow recording of manual or other data from the cockpit. It may also provide, for instance, data display and system test and control functions. The functions and the use of the FDEP are as determined by the manufacturer and/or the system user.

The maximum size and the DFDAU wiring interfaces are specified in this Characteristic.

3.3.6 Other Optional Units

No other units than those above are covered by this Characteristic but certain provisions have been made to aid in the design of a larger system. There are clock and synch inputs/outputs specified for the DFDAU to simplify system timing and a block of contacts have been reserved for a manufacturer's and/or system user's special needs. It should be recognized that the use of the unspecified connections may limit the interchangeability of DFDAUs between installations.

3.4 Data Sources

The DEFDARS should accept input data form existing transducers provided as part of the aircraft subsystems or from additional transducers or signal conditioners installed primarily as DEFDARS signal sources. The raw electrical signals accepted by DEFDARS should conform to one of the basic input signal categories of Section 4.

Transducers installed for DEFDARS should not be considered a part of the DEFDARS for purposes of system accuracy except as specifically stated in this document.

3.5 Data Multiplexing

The input data to the DFDAU should be time division multiplexed into a fully serial output with parameter identification provided by means of data frame position or "time slot addresses" as shown in Section 5 and Attachment 4.

3.0 SYSTEM DESIGN (cont'd)

3.6 Data Format

The data frame to be recorded by the flight recorder while used for mandatory flight recordings is specified by this Characteristic. Synchronization is by a Barker coded word and individual data is found in word slots referenced to the synch word.

Attachment 4 has a complete description of the data frame.

COMMENTARY

This data frame is similar to the one specified for ARINC 573 and that is quite intentional. The ARINC 573 frame has proven adequate for most users. With a lot of equipment now in use to transcribe and process ARINC 573 data, the airlines wish to retain enough commonality to avoid expensive duplication. The DFDRs developed to ARINC 573 and made part of this Characteristic depends on the ARINC 573 bit rate format for functions like BITE and meet regulatory requirements for data retention. This requires that the synch method, the word length and the frame length be the same.

3.7 Input Signal Programming

The DFDAU will accept inputs from a multitude of sources with different types of signals. Since each word slot in the output frame corresponds to a certain parameter input at a certain set of pins, the allowable type of signal has been specified for all inputs. In some cases, this specification will allow only one type of input for certain data while in other cases there is a choice of types of input allowed.

The customer specified ROM will fully determine what data is in any given word, which input pins are sampled to find this data and which signal conditioning is used to resolve the data. See Section 5.7 for a discussion on undefined programmability.

3.8 Input Circuit Protection

Each data input circuit in the DFDAU should include suitable circuitry to prevent malfunctions or failures appearing in the monitored aircraft system as a result of failures in DEFDARS. This circuitry should protect the aircraft sensors, transducers or instrument systems against all reasonably probable malfunctions including non-programmed multiplex switch closures. This protection should continue to exist even in the event of any reasonably probable failure within the isolation circuitry itself and with power-off conditions. Detailed characteristics should be as given in Attachment 7.

3.9 System Accuracy

The total error contributions from the input to the DFDAU through the Digital Flight Data Recording readout or playback should meet the specifications in Section 4.

3.10 Failure Warning and Functional Test

Equipment designed to this Characteristic should have adequate failure monitoring and functional test capability. Equipment should be designed to ARINC Report 604, "Guidance for Design and Use of Built-In Test Equipment (BITE)". ¢-9

3.10.1 "Minimum Requirements"

Means should be provided in the equipment for preflight "dispatch" tests. As a minimum, such tests should determine that data is being "written" on the recording medium in the DFDR This is the "SYSTEM STATUS" signal from the DFDR shown in Attachment 2.

Failures should be indicated by the change from a "Standard Applied Voltage" (nominally + 27.5 VDC) to a "Standard Ground" signal on the "SYSTEM STATUS" output (DFDR pin 21) as shown in Attachment 10. This signal should be capable of controlling lamp or relay load within the range of 10 to 100 milliamperes where the power is derived from a standard +27.5 VDC aircraft electrical system including the voltage transients described in ARINC 413, however, the +27.5 VDC may be reduced to approximately 12 VDC where the power is supplied from a "Master" dimmable lighting bus. Further, the cautious AIDS design may wish to give some thought to the possibility that the airframe people might choose to use AC power and SCRs in the future for such dimmable buses. The externally connected low for the FDEP indicator allows the use of dimming on the ground side.

NOTE: This dual-character signal is provided to allow customers that option of indicating a detected failure by means of:

A. The traditional amber caution light used in existing Flight Data Recorder installations, or

B. The electro-mechanical type of "Flag" used on most instruments.

Some airlines have indicated a desire to use the electro-mechanical warning devices for various reasons. However, it should be noted that a failure of the Flight Data Recorder is not a critical flight safety item, in the same sense as the flight instruments. Thus, provision of the dual-character signal is justified solely on the merits of instrumentation flexibility (as shown in Attachment 10) and not on any need for an "ultra-sophisticated" failure warning indication.

COMMENTARY

The present state-of-the-art in failure monitoring, circuitry appears adequate to meet the "Minimum Requirements" set forth above. However suggestions to include an additional requirement to automatically verify the validity of the recorded data were found to be beyond practicable attainment in actual operational environment for the foreseeable future.

3.0 SYSTEM DESIGN (cont'd)

COMMENTARY

It should be noted that monitoring for recorded data provides an inherent check that power is applied, data is being received from the DFDAU and the tape is in motion.

3.10.2 Customer Needs

Many airlines have expressed a need for a more comprehensive "Maintenance Monitoring System" which is capable of isolating faults to a line replaceable unit (LRU). Such systems should indicate the failed unit by means of an indicator on the front panel of the DFDAU. The color of the indicator should correspond to the mounting surface when the monitored unit is satisfactory and should indicate failed units by displaying the Standard Yellow.

COMMENTARY

Detailed requirements for Built-In Test Equipment (BITE) are not given since the pressures of the "marketplace exert a compelling necessity for the designer to ensure a high maintainability for the equipment. It is expected, therefore, that BITE equipment will detect at least 95% of failures and assign these to the correct LRU with a probability of at least 95%.

4.0 STANDARD SIGNAL CHARACTERISTICS

The purpose of this section is to specify the detailed electrical characteristics of the analog, digital, and discrete electrical input and output signals. All inputs and outputs of the DFDAU should meet the standards established for the types of signal specified in this section.

COMMENTARY

Installation designers should take note of the fact that special optional DFDAU inputs or another data conversion device will be needed in those cases where it is desired to use any input signal which does not meet the standards of this section.

4.1 Interface Standards

The interface standards are necessary to ensure interchangeability and to preserve the integrity of the aircraft systems to which DEFDARS is connected.

All the electrical inputs to the system will be in the form of either a standard analog input, a standard digital format or a standard switch function. Standards will be established by this Characteristic to ensure interchangeability of wiring, and thus the interchangeability of equipment.

In the definition of interface standards this Characteristic includes accuracy, resolution, and the signal source standards as applicable.

4.1.1 General Accuracy and Operating Ranges

The accuracies specified herein should apply under all combinations of environmental conditions of Section 2.7. The accuracies for the various analog output functions should be measured on the electrical signal outputs of the system and, therefore, the accuracy figures specified do not include the typical reading inaccuracy of displays on the pilot's instruments. In all cases the error contribution is expressed as a percentage of full scale, and represents the RSS value of all sources of error. The specified accuracy for each input signal of Section 4.2 should include any non-linearity and resolution in the analog-to-digital conversion process.

COMMENTARY

The specified error contributions or "Accuracy" limits represent the absolute MINIMUM values which the users will accept. The designers should take note of repeated airline requests for significantly better accuracies especially where the data is to be actually used for AIDS purposes. In such cases, the airlines may choose equipment with accuracies far better than the maximum values specified by this characteristic.

4.1.2 Resolution

For purpose of this Characteristic the resolution or the function threshold sensitivity is considered to be the maximum cyclic input change (double amplitude) that can occur without detectable change in the output. The resolution of all analog-to-digital conversions should be 1/4096 of full range, or better.

4.1.3 Synchro Standards

All inputs for which synchro signals are specified should consist of signals from standard 26 volt synchros, utilizing 11.8 volt leg-to-leg stator voltages of a sufficient size to permit operation of at least three passive repeater synchros or three high-impedance (500 ohms or greater) control transformers or any combination thereof externally. It may be assumed that all such high impedance control transformers used externally will be operated into a rotor load impedance of at least 10,000 ohms (instead of 100,000 ohms as recommended in the manual) for the reasons which are described in Sections 4.14 and 4.20 of ARINC Report 407, "Synchro System Manual".

COMMENTARY

Oftentimes set manufacturers are inclined to use the terminology "EZ" instead of the term "Index Reference." The term "EZ" applies to a synchro indicator. The fine distinction between these two terms and the problems that can develop because of an indiscriminate use of the term "EZ" when "Index Reference" should be used instead are explained in Section 2.2 of ARINC Report 407, "Synchro System Manual". Manufacturers should make reference to ARINC Report 407 for detailed information on system interconnection of synchro indicators so that they will be aware of the pitfalls in the use of the "EZ" terminology.

4.1.4 Standard "Applied Voltage"

The standard "applied voltage" should consist of nominal +27.5 VDC signal. This voltage should be considered "to be applied" when the actual voltage under the specified load conditions exceeds 18.5 volts and to "not-be-applied" when the potential on this lead drops to 3.5 volts or less. ¢-9

4.1.5 "Standard Ground" Signal

The "Standard Ground" signal may be generated by either a solid-state or mechanical type switch. In either case, a "contact potential" or residual voltage of 3.5 volts or less should represent the "grounded" condition.

4.1.6 Phase Reversing Voltage Standards

Several functions employ a phase reversing voltage signal for external instrument and accessory use. Unless otherwise set forth, the phase of these output signals is to be held to $0° \pm 10°$, with the "in-phase" signal produced by motion in the positive direction, or a derivative of that direction. The positive direction senses for all usual airplane or environment signal changes are defined in ARINC Report 407. The quadrature signal should be held to less than 60 millivolts, unless otherwise noted, under the worst condition for each of these phase reversing output signals.

4.0 STANDARD SIGNAL CHARACTERISTICS (cont'd)

The above specified 0° and 180° phase relations are applicable irrespective of the source of the phase reversing voltage signal, whether a tach generator, a two-wire synchro output, a linear inductive transformer, or even a potentiometer.

The basic phase reference standard is to be the aircraft power system – not an arbitrary phase reference established by any accessory.

For purposes of indicator and accessory unit design it is expected that individual utilization equipments will have a nominal input impedance of 10,000 ohms (or more), essentially resistive so that a total of three loads can be employed in the aircraft. This standard is based on Section 11.1 of ARINC Report 407.

4.2 Analog Data Inputs

The following types of analog signals should be accepted by the DFDAU. In cases where a reference or excitation voltage is stated, the value given is the nominal. For all types of signals the digital value should be linear with the input over the entire specified range.

The synchro inputs should be programmed to use the proper reference signal. There are five reference voltage inputs using the AC ground for return. The five references should always include the three phases of the aircraft power generating system with the other two inputs to be used for reference voltages from special equipment as needed for each installation.

The AC ratio reference signals are expected to meet the standards for the 26VAC reference defined in ARINC Report 407.

¢-2 As an option, the DFDAU should be capable of processing the special signal types defined in Sections 4.2.8 and 4.2.9. These signals should be assigned to the pins designated in Attachments 2-2 and 3.2.

4.2.1 Synchro Signal

Range:	0 to 360° (continuous unlimited rotation)
Voltage:	11.8 VAC line to line at 26 VAC ref.
¢-3 Reference Voltage:	26 VAC 400 Hz nominal (30 VAC max.)
Digital Scaling:	0° is zero count and 360° is full count plus an additional binary 1, e.g., all zeros.
Accuracy:	±0.17% (0.6°)

COMMENTARY

All synchro signals should conform to the standards set forth in ARINC Report 407.

AIDS designers should note that the reference or excitation voltage for the synchro signals (H) is provided as an input, because the various synchros are normally connected to special instrumentation power buses. These buses are normally supplies from different alternators and/or phases than that used for DEFDARS primary power.

4.2.2 AC Voltage Ratio 1

Range:	0 to 5 VAC in and out of phase referenced to 26 VAC 400 Hz excitation nominal (30 VAC max.) ¢-3
Digital Scaling:	5 VAC out of phase is zero count and 5 VAC in phase is full count.
Accuracy:	±0.2% (20 mVAC, nominally)

4.2.3 AC Voltage Ratio 2

Range:	0 to 26 VAC-in and out of phase referenced to 26 VAC 400 Hz excitation nominal (30 VAC max.) ¢-3
Digital Scaling:	26 VAC out of phase is zero count and 26 VAC in phase is full count.
Accuracy:	±0.2% (104 mVAC, nominally)

4.2.4 DC Voltage

Range:	0 to 5 VDC (absolute measurement)
Digital Scaling:	0 VDC is zero count and 5 VDC is full count.
Accuracy:	±0.2% (10 mVDC)

4.2.5 DC Voltage Ratio (3-wire input)

Range:	0 to 5 VDC
Reference:	5 VDC
Digital Scaling:	0 VDC is zero count and 5 VDC is full count
Accuracy:	±0.2% (10 mVDC, nominally)

4.2.6 Potentiometer (1 to 10 kohm)

Range:	0 to excitation voltage
Excitation:	Nominally 5 VDC (From the DFDAU
Digital Scaling:	0 VDC is zero count and excitation voltage is full count
Accuracy:	±0.2% (10 mV, nominally)

4.2.7 Resistance (90.38 ohm 3 or 4 wire) ¢-1

Range:	68.27 ohm to 242.70 ohm
Digital Scaling:	68.27 ohm is zero count and 242.70 ohm is full count
Accuracy:	±0.5% (0.87 ohm)

NOTE: Each probe input should provide its own excitation. There are sixteen probe excitation sources as shown in Section 4.6.3. This input is provided primarily for use with a temperature probe.

COMMENTARY

Apart from the various types of analog inputs here specified, there were several others suggested. These had primarily applications for expanded data acquisition system and it was felt that rather than complicate the basic DFDAU as used for mandatory purposes these other inputs may be provided by the manufacturer as requested by the individual user. The signal types most frequently asked for were: DC voltages in the millivolt range, bi-polar DC voltages and tachometer (frequency) signals.

4.0 STANDARD SIGNAL CHARACTERISTICS

4.2.8 Strain Gauge

Range:	0 to 50 mVDC
Accuracy:	0.2% of full scale
Digital Scaling:	0 mVDC - zero count 50 mVDC -full count
Positive Excitation:	+20 VDC max.
Negative Excitation:	-20 VDC max.

¢-2

4.2.9 Thermocouple

Type:	Chromel/Alumel
Range:	0-35 mVDC

¢-2

NOTE: Cold junction compensation should be provided internal to the DFDAU. Accuracy and digital scaling should be user defined.

4.3 Digital Data Inputs

The digital data inputs are all in serial form with data words transmitted at intervals. All data should adhere to that defined in ARINC Specification 429. There are 16 separate ARINC 429 input ports in the BASIC DFDAU.

¢-9

The least significant bit (LSB) carries the lowest bit number in all cases. Wherever possible, the DFDAU should read one more LSB of data than to be recorded and round the recorded LSB for increased resolution.

The data recorded should be the latest taken from the ARINC 429 source.

If the input data exceeds the range used for the DFDAU data, the DFDAU data should be held at full scale.

4.3.1 Labeled Aircraft Data

Aircraft data using the ARINC 429 format will have labels identifying the data. The DFDAU should decode the labels and the Source/Destination Identifier (SDI) for all ARINC 429 data in the customer assigned data words. For instance, airspeed may be recorded with 10 bits as word 19 of all subframes with the data taken from Air Data System 2. The DFDAU will receive the ARINC 429 word addressed as octal 206, SDI binary 00, reading bits 18-27, using bit 17 to round.

¢-9

4.3.2 Labeled System Data

In the specially dedicated optional input ports, the DFDAU may receive data from special sources. The labels for this data may be assigned by the system designer without AEEC staff coordination if the data has no other users.

Data of this kind may typically come from other units of an expanded system or from other systems providing specially coded AIDS data.

4.3.3 FDEP Data

The data interface between the FDEP and the DFDAU is not specified by this Characteristic but it is expected that if the ARINC 429 data format is used, it will have data labels assigned by the user.

4.3.4 DFDR Playback Data ¢-1

The DFDAU should receive from the DFDR and transmit to the FDEP the DFDR data as shown in Attachment 2. In its simplest form this may be done by direct internal jumpering but the DFDR data could also be used by the DFDAU to enhance the failure monitoring or the FDEP interaction. The on-board data playback output may be brought out to a front connector. ATE connections should also be made at this connector.

COMMENTARY

In the ARINC 573 system, the DFDR output was brought to the FDAU and mostly used for playback of the recorder data when the DFDR had a fast-playback feature. ARINC 573 did not ask for the DFDR data to be brought to the FDEP and this has now been recognized as a shortcoming.

4.3.5 Bus Fault Protection

The ARINC 429 input ports should be designed to operate with bus voltages within the ranges specified in Attachment 3 to ARINC Specification 429. Voltages falling in the undefined regions between "Null" and "High" or "Null" and "Low" should cause the input port to discontinue decoding the signals. The input ports should return to normal operation when the voltages on the bus are returned to the specified ranges. ¢-9

COMMENTARY

The foregoing reflects the need to preclude incorrect ARINC 429 bus operation when single-wire faults (open circuit or short circuit to ground) produce bus voltages outside the ARINC Specification 429-defined ranges. Manufacturers should note that the users desire such faults to be covered by equipment monitoring/BITE, to the extent possible. Users are cautioned, however, that such faults can occur outside black box boundaries and that normal maintenance action in response to an annunciated failure (i.e., black box replacement) may not result in the fault being cleared. ¢-3

4.4 Discrete Data Inputs (On-Off Signals)

This section describes the types of individual binary, On-Off or "Discrete" signals which should be accommodated by the DFDAU.

4.4.1 Series Discrete

Range: 0 to 32 VDC.
State 1 is defined as any voltage greater than +7.0 volts.
State 0 is defined as any voltage less than +3.0 volts.
An open-circuit input is also defined as State 0.

4.4.2 Shunt Discrete (Diode Isolated)

Range: 0 to 32 VDC.
State 1 is defined as any voltage greater than +7.0 volts.
State 0 is defined as any voltage less than +3.0 volts.
An open-circuit input is also defined as State 1.

4.0 STANDARDSIGNALCHARACTERISTICS(cont'd)

NOTE: The DFDAU should provide diode isolation on all shunt discrete inputs to prevent interaction between DEFDARS and the sensor circuit.

4.4.3 AC Sensitive Discrete

Range: 0 to 120V, AC or DC
State 1 is defined as any voltage greater than 18 volts.
State 0 is defined as any voltage less than 7 volts.

¢-1 | An open circuit constitutes state 0.

COMMENTARY

These three classes of discrete utilize voltage levels to define the two binary states. One uses an AC or DC voltage signal and the other two use only DC signals. For many purposes, they may be used interchangeably, where the aircraft discrete being monitored has a low impedance in both State 1 and State 0. The difference between them shows an open input line.

The "series" discrete draws current out of the source when in State 1, and may, therefore, be used where a switching device in the sensor interrupts the voltage. The "shunt" discrete draws current from the DFDAU in State 0, and may, therefore, be used with any switch to ground. The "shunt" discrete is particularly intended for grounded switches requiring diode isolation, for example, press-to-test. The ARINC 573 ratio of 3 to 1 for series/shunt switch quantities has been retained.

There is a need in certain cases to monitor the presence of an AC voltage. A special input, as in Section 4.4.3, is the only way to combine this need with the impossibility of a simultaneous firm definition of the open state. After all, the noise to be filtered off the open line may be of the same 400 Hz to be monitored.

4.4.4 Timed Discrete

It should be possible to resolve, to within one eighth of a second, the time of a change of state of any of the signals received via the dedicated discrete input pins. Each DFDAU should be capable of "timing" up to four discretes, with the particular discretes selected for timing and the method used being agreed upon between the user and the DFDAU manufacturer.

¢-1 | COMMENTARY

One method proposed for the timing is to allocate a three-bit counter for each signal being timed. The counter is set to zero and started at the beginning of each subframe, and the signal state is checked. A change of state is used to stop the counter and the counter content is recorded at the end of the subframe. Careful consideration of this proposal will reveal that there are a number of potential problems in providing adequate timing, and the method used should be thoroughly analyzed to ensure that no ambiguities can occur.

4.4.5 Marker Beacon Discrete

Frequency Range:	400-3000 Hz
Duration:	1 to 10 seconds
Modulation:	60% on, 40% off
Waveform:	Crest factor 4.0 maximum
Range:	0 to 7V RMS

State 1 is defined as any voltage greater than 2.5 V RMS.

State 0 is defined as any voltage less than 1.5 V RMS.

COMMENTARY

The characteristics of the Marker signals given in Section 4.4.5 are applicable to the three lamp outputs of "pre-ARINC 717" Marker Beacon Receivers. There are no industry standards which define these signals. The circuits designed for ARINC 575 FDAU's all worked well with these signals. When the discrete signals available from an ARINC 711, "Mark 2 Airborne VOR Receiver" are connected to indicator lamps powered by a voltage greater than 7 VDC, they are suitable for connection to an ARINC 717 FDAU as "Series Discrete" inputs. Also, Marker Beacon signals are available in digital form as bits 11, 12 and 13 of the VOR omnibearing word which is contained in the ARINC 429 digital output data of the ARINC 711 Mark 2 VOR Receiver. ¢-3

4.4.6 Ident Inputs

There should be 20 input pins which will be used for identification purposes. Seven pins will identify the aircraft type and the codes used should be registered with the AEEC staff at ARINC. Four pins will be airline coded fleet identification, eight will be the airline coded identification of individual aircraft and one will be identification common. ¢-10 ¢-2

Each of these will be coded by either open or connected to the identification common pin. The connection to identification common should indicate the logic "1" state. See Attachment 5-3.

4.5 Reference Inputs

The synchro signal conditioners may use any of the three aircraft power phases for reference as shown in Attachment 2. In addition, there are two pins which may be used for any special phase reference required by any installation. The ROM function which selects appropriate input pins for the data will also select the proper reference as required.

The load on any reference input should be as shown in Attachment 7.

4.6 Reference Outputs

A number of standard Reference Outputs or "Excitation Power" outputs (sometimes referred to as "Excitation Signals") are provided for use by various sensors. Installation designers should select sensors compatible with one of the outputs described in this section.

NOTE: The short term stability of this reference voltage should be very good in order to ensure adequate accuracy in the digitized data.

4.0 STANDARD SIGNAL CHARACTERISTICS(cont'd)

4.6.1 Potentiometer

4.6.1.1 Potentiometer Reference Voltage (+5VDC)

Source: DFDAU Power Supply
Amplitude: +5 VDC ±20%
Load Capacity: 200 Milliamps

4.6.1.2 Potentiometer Sensing

A Potentiometer sensing input should be provided as an option.

NOTE: A potentiometer sense wire is not needed, but could prove useful when an number of potentiometers are fed from a distribution bus situated some distance from the DFDAU.

4.6.2 Accelerometer Reference Supply (+28 VDC)

Source: Regulated power supply in DFDAU
Amplitude: 28 VDC ± 4 VDC
Load Capacity: 100 milliamps

NOTE: This output is provided for use by the standard accelerometer. The quality of this power, especially freedom from voltage transients, should be "better than MIL-STD-704." However, there is no agreement on how much better.

4.6.3 Probe Excitation

A temperature probe needs external excitation and the DFDAU should provide 16 excitation sources-each to be used with any of the 16 analog inputs that may accept a probe input (See Attachment 5-1). Two excitation returns should be provided, one for odd numbered probes, the other for even numbered probes.

NOTE: The self-heating produced by the excitation will produce sensor error. Therefore, normal excitation power levels may be made lower than the "sensor damage" limits and may vary between different types of sensors. A typical excitation power level of 150 mW is considered adequate for many probes.

4.7 Standard Outputs

4.7.1 DFDR Output

The DFDR output is primarily for use with the mandatory flight recorder. It should use Harvard Bi-phase coding per Attachment 9-2 and the format should be as described in Section 5.3.

4.7.2 Auxiliary Output

¢-1 The auxiliary output carries the data in a user-specified format and is modulated in Bi-polar coding per Attachment 9-5 and Section 5.3.

4.7.3 DFDR Playback Output

The DFDR playback data of Section 4.3.4 could have any format either as supplied by the DFDR or otherwise as specified by the DFDAU manufacturer for a particular FDEP interface.

4.7.4 BITE Output

The DFDAU BITE output should have the following characteristics:

NO FAULT: Presence of aircraft ground - less than 0.5V at 10 mA.

FAULT: Open Line - less than 100 microamps at 32 VDC.

NOTE: The airlines have expressed a desire NOT to provide a manually operated DFDAU "Self Test" intended for use by the flight crew. The dispatch test of Section 3.10 should be sufficient status check.

4.8 Non-standard Outputs

Pins have been assigned for optional outputs or control functions. It is expected that no other reserved pins be used for outputs or for low-impedance ground or voltage sources. This should make possible the required interchangeability without damage to the DFDAUs. These pins may be typically used for a high-speed data output and a quick access recorder on/off control.

5.0 DIGITAL FLIGHT DATA ACQUISITION UNIT DESIGN

5.1 DFDAU Functions

5.1.1 Hardware Functions

The DFDAU should as minimum contain the circuitry needed for the following functions:

- Control Oscillator (Input/Output)
- Input signal isolation and signal conditioning
- Analog to digital conversion
- DFDAU control logic and data frame formatting
- Excitation signal sources
- Data output drivers
- BITE
- Power Supply

5.1.2 Firmware Functions

To be a functional unit the DFDAU should in addition to the circuitry of Section 5.1.1 also contain a read-only-memory (ROM) with the following functions.

- Assign all word slots to data, providing the parameter choice and the sampling rate and sequence needed for the application.

- Program the analog inputs to switch all sampled parameters including references to the appropriate signal conditions.

- Program the ARINC 429 ports to sample the data with the appropriate label and SDI information as required for the application.

This ROM is user specified for each application.

COMMENTARY

Since it is expected that this ROM will provide the key for each installation and each application there will likely be a frequent desire to "reprogram" the DFDAU as need arises and as the user finds new and better ways to employ the spare capacity of the DFDAU. That means that the manufacturer who hides this ROM deep inside his box, making it a permanent part of the chassis or the manufacturer who makes it expensive to "reprogram" is likely to find a very small market.

5.2 DFDAU Inputs

5.2.1 Aircraft Parameters

The DFDAU should contain signal conditioning capable of accepting all of the standard signals described in Section 4. The DFDAU should convert the data to 12-bit digital form with the specified accuracies, while aircraft ground voltages of up to 2VRMS are present between sensor signal output and DFDAU signal ground. Input isolation should be in accordance with Section 3.8 and Attachment 7.

5.2.2 Documentary Data Input

Data entered on the record from the FDEP, an optional Multi-Purpose Control Display Unit (MCDU), or other means is called documentary data and there should be one 12-bit word in each frame allotted for this data in the same subframe as the frame counter (see Section 5.5.4). ¢-7

The DFDAU should, in this word, continuously output the latest documentary data received from the FDEP or optional MCDU. ¢-9

COMMENTARY

Neither the data format nor the electrical format for the data exchange between DFDAU and FDEP are part of this Characteristic. One suggested organization of the data permitting a variety of information to be entered in the data word, assigns three BCD digits in each of several Documentary Data words and uses the Frame counter to identify the data. The interface and protocol for the MCDU is described in the ARINC Characteristic 739 (see Section 8.0). ¢-7

5.3 Output Data Formats

5.3.1 Data Addresses

The DFDAU flight recorder output data is identified by means of frame position or "time slots" addresses. The input data should be sequenced into the order controlled by the ROM of Section 5.1.2.

5.3.1.1 Frame Structure

The basic outputs should have the data organized into a "Frame" which is repeated every four seconds. Each frame should consist of four "Subframes" which occupy one second each. Each subframe consists of 64 (basic rate), 128, 256, or 512 12-bit words depending on the data word rate specified for the system. Discrete data may be packed into discrete words or assigned as part of an analog data word. ¢-10

5.3.1.2 Frame Synchronization

The first word in each subframe should provide a frame synchronization pattern. This pattern consists of various configurations of the Barker Code and includes identification of each subframe. Specific synchronization bit patterns are shown in Attachment 4.

The octal codes for subframe 1-4 sync words are 1107, 2670,5107, and 6670 respectively.

COMMENTARY

The way the Barker code bit pattern was first shown in ARINC 573, it could be misunderstood. Consequently it was, and about half of all ARINC 573 FDAUS have it on way and half the other. It complicated the transcription equipment but when found out it was too late to adopt one standard. After research into the original intent and into the effects of having it one way or the other, it was decided that this Characteristic should have only one pattern. Therefore the two ends of the binary word of Attachment 4 have now been identified by MSB and LSB respectively.

5.0 DIGITAL FLIGHT DATA ACQUISITION UNIT DESIGN (cont'd)

5.3.2 DFDR Output Data Bus

This output should be sequenced in full accordance with Section 5.3.1. It should consist nominally of 64 12-bit words per second at a bit rate of 768 bits per second in Harvard Bi-phase coding. Provisions should also be made ¢-10 to accommodate output rates of two, four and eight times the nominal rate, i.e., 128, 256, and 512 12-bit words per second.

The equipment manufacturer may at his option include the capability for direct drive of the DFDR head. In such equipment, as a minimum, this output circuit should ¢-1 deliver a current of 40 mA into a 50 ohm load.

5.3.3 Auxiliary Output

This output should be sequenced according to the user in bi-polar electrical coding.

COMMENTARY

Some airlines see a need to connect a quick access (cassette type) recorder to the DEFDARS for certain flight test or such a recorder is fitted as part of an expanded system. This recorder will be connected to the auxiliary output to ensure the integrity of the flight recording

5.4 Optional Digital Port

The user may specify the need for a port that provides the digital equivalent of the analog input values. The port should have an output format corresponding to ARINC 429. The parameters to be available at this output port should be controlled by the user-specified software. The ¢-2 label assignments need not agree with the assignments in ARINC 429.

COMMENTARY

Due to large numbers of parameters that may be transmitted from this port, bus loading can be extremely heavy. It is realized at times that actual timing will preclude parameters from being transmitted with the maximum specified interval. Equipment connected to this port should allow for this occurrence.

5.5 Self-Test and Maintainability

5.5.1 Fault Indication

The DFDAU should be equipped with Built-In-Test-Equipment (BITE) to determine its status. A fault output should be provided which may be interconnected with the FDEP for fault annunciation and isolation. (See Section 4.7.4)

5.5.2 Self-Calibration (Optional)

In an expanded system the parameter conversion accuracy may be improved through the use of self-calibration. The exact method to be used will be specified by the manufacturer and/or user in each case.

5.5.3 BITE Status Word

For ground data processing, the BITE status should be recorded at least once per frame. The BITE word should, as a minimum, contain the BITE flag and preferably complete information of the BITE status, such as reason for a BITE flag, calibration information, etc.

5.5.4 Running Frame Count

To allow detection at ground processing of short-time data loss due to recorder or synchronization problems, the output data frame should contain a running frame counter. The counter is incremented once per DFDAU output frame continuously counting from 0 to 4095 in straight binary.

5.5.5 Selectable Call-Up of Parameters

Some airlines have expressed a desire to be able to select any given parameter from the DFDAU or the DFDR for display on the FDEP. Manufacturers may wish to cater to this stated need by providing this feature as an option with their FDEP. The standard interwiring provides data lines and control wires for this function and also a DFDR read output to the DFDAU.

5.6 Excitation Output Signals

Excitation power should be provided by the DFDAU for sensors used for the DEFDARS and not electrically interconnected with other aircraft systems. These sensors may include the standard accelerometer, potentiometer, temperature probes, and series switches for discrete inputs. The electrical characteristics of the excitation power is specified in Section 4.6 for interchangeability.

5.7 Undefined Programmability

Certain pins have been reserved in the DFDAU connectors for use at the manufacturer's option in providing an undefined data output and undefined control functions for use in installations where more extensive data processing is needed.

COMMENTARY

The optional output and additional unspecified functions have been suggested to meet the anticipated need of some customers who plan to make use of on-board data processing equipment of otherwise use the DFDAU for other than mandatory flight recording. In such installations several DFDAU's may be used together with special units to greatly increase the number of sensors and systems monitored by the expanded system. The manufacturer should carefully plan the expansion and reprogramming capabilities built into his DFDAU to make it attractive without losing sight of the economics of basic flight data recording which, after all, is the primary need.

6.0 DIGITAL FLIGHT DATA RECORDER (DFDR)

The Digital Flight Data Recorder (DFDR) should accept the digital output as shown in Section 4.7.1 and should contain the circuitry necessary to interface with the Digital Flight Data Acquisition Unit.

6.1 Recording Capacity

The Recorder should be capable of recording and retaining the DFDR data output for a minimum period of 25 hours.

6.2 Self Test

Monitoring Circuitry or "self-test" means should be provided to assure reasonable certainty of proper operation as shown in Section 3.10.

Two status output signals should be provided which should be interconnected with the FDEP and DFDAU for fault annunciation and isolation as shown in Attachment 2 and 10.

6.2.1 System Status

The DFDR monitoring Circuitry should provide a failure warning output as shown in Section 3.10 and Attachment 10.

6.2.2 Maintenance Flag Output

The DFDR monitoring circuitry described in Section 3.10 and shown in Attachment 2 should provide an output to operate the "Maintenance Flag" annunciator(s) on the DFDAU. This signal should consist of a "Standard Ground" signal as described in Section 4.1.5 when the DFDR is functioning properly. When a failure is detected this output should consist of essentially an open circuit (100,000 ohms) or more.

COMMENTARY

The logic used by these two outputs is different in order to facilitate more comprehensive monitoring within the DFDAU.

6.3 Power Inputs

The DFDR should be self sufficient (i.e., have its own power supply, etc.) such that it is not dependent on the DFDAU for other than a data stream input. Power requirements should be as shown in Section 2.5.1.

6.4 Protection

The DFDR should meet the survival requirements of TSO C-51A.

The French regulatory agency, SGAC requires a secondary structural connection as shown in Attachment 3-3.

Most regulatory agencies require an Underwater Locator device be attached to the front of the DFDR and most airlines require that this device be serviced without disassembly of the recorder.

6.5 Data Input

The data input should be as specified in Attachment 9-4. The DFDR should also be insensitive to transient inputs of up to an amplitude and duration product of 50×10^{-6} volt seconds, and of negative or positive polarity.

7.0 ACCELEROMETER DESIGN

7.1 Accelerometer Description

The standard accelerometer should be a pressure sealed instrument for measuring acceleration along all three axes. The accelerometer should be designed to protect against damage from excessive accelerations of up to ten times full scale values.

The accelerometer should meet the following ranges as indicated below.

AXIS	RANGE	OUTPUT
Forward	+1g	5000mV
Aft	-1g	200mV
Right	+1g	5000mV
Left	-1g	200mV
Up	+6g	5000mV
Down	-3g	200mV

COMMENTARY

Equipment designers should take note of the conflicting "requirements" for sealing the accelerometer unit. The aircraft environment dictates extremely good sealing, including protection from pressure cycling in the presence of Skydrol and other highly "active" aircraft fluids. However, the airline people are strongly opposed to most, if not all, "conventional" hermetic techniques. Such techniques are not normally conductive to standard airline maintenance and overhaul methods. And the airlines will undoubtedly wish to overhaul these accelerometers as they now do with other similar equipment. Thus a very good seal is needed, but at the same time it must provide convenient shop access for maintenance.

NOTES:

1. In some installations the accelerometer may be located in a potentially explosive environment and the sealing design should take this factor into account.

2. At the option of the customer an accelerometer having outputs in only two axes (Vertical and Lateral) may be used in place of the above described unit. Such two-axes units should be mechanically and electrically interchangeable with the standard accelerometer in all respects except for the absence of the longitudinal output.

   In such cases the standard aircraft interwiring should include wires for longitudinal axis output to facilitate any future installation of a standard three axes accelerometer.

7.2 Excitation

The Excitation should be 28 ±4 VDC as shown in Section 4.6.2.

7.3 Signal Outputs

7.3.1 Signal Levels

The signal outputs should be linear over a range of +200 to +5000mV. This voltage should represent full scale of loads as shown in Section 7.1. Axial nulls should be represented by the following voltages:

Vertical Null is + 1800 ±25 mVDC

Lateral Null is +2600 ±25 mVDC

Longitudinal Null is +2600 ±25 mVDC

7.3.2 Error Band

The output signal level at any acceleration input within the ranges in Section 7.1 should produce an output which does not deviate from a straight line connecting theoretical full scale end points by a value greater than 0.75 % of the full range output.

7.3.3 Temperature Effects

7.3.3.1 Null Output

The null output signal levels should not change by more than 0.01% (of the full range output value) per degree F over the temperature range of -65°F to +160°F and in any event should not exceed ±60 mVDC.

7.3.3.2 Sensitivity

The output signal levels or sensitivities in Section 7.3.1 should not change by more than 0.01% (of the full range output value) per degree F over the temperature range of -65°F to +160°F. ¢-2

7.3.4 Resolution

The output signal resolution should be better than 0.01% of full range.

7.4 Filtering (Output Frequency Response)

The accelerometer should contain effective filtering means to screen out undesired high frequency vibration data. The output signal level should be 3 dB below the signal levels in Section 7.3.1 for vibration having a frequency of 4Hz. At higher frequencies the output signal levels should continue to decrease at the rate of 12dB per octave.

7.5 Weight

The weight of the standard accelerometer unit should not exceed 24 ounces.

8.0 FLIGHT DATA ENTRY PANEL DESIGN (FDEP)

8.1 General

The optional FDEP may allow the manual entry of certain documentary data from the cockpit. Typical data of this kind are date, trip, number, flight leg, fuel data, etc.

The FDEP may also be used to provide pre-flight system test, fault annunciation, troubleshooting assistance and data display. In an expanded DEFDARS the FDEP may be designed to control the system and to provide computer interface and other advanced functions.

Due to its dependence on the actual system design and the direct dependence on the DFDAU capabilities, a FDEP is expected to be always coupled with a particular DFDAU with no interchangeability required between manufacturers.

COMMENTARY

Despite all this uncertainty about the FDEP features this Characteristic provides for standard interwiring to the FDEP and it defines some of the FDEP-DFDAU functional interface, mostly in order to firm up the DFDAU design.

8.2 Unassigned DFDAU Interface

The details of a DFDAU interface should be determined by the DFDAU/FDEP manufacturer. The standard interwiring of Attachment 2 provides for a number of wires for this purpose.

8.3 Assigned Interface

8.3.1 Signals

The FDEP will receive a System Status Signal from the DFDR and a DFDAU BITE signal from the DFDAU. The FDEP will provide a dedicated Event Marker Shunt Discrete for the DFDAU (Discrete Switch Input No. 1)

8.3.2 Power

8.3.2.1 FDEP Power

The FDEP should be self-contained using standard aircraft 115 VAC/400 Hz power.

8.3.2.2 FDEP Illumination

The FDEP illumination, except for the display, should be connected to the aircraft dimmable supply. The FDEP display should be illuminated by the internally generated supply controlled by a potentiometer on the panel.

8.4 Automatic Means for Entering Documentary Data

8.4.1 ARINC 429 General Broadcast Data

¢-7

As a number of systems, e.g., ACARS, Control Maintenance Computer, may need the same documentary data as that recorded on the flight recorder, one unit may be assigned to receive the data entered in the flight deck and to retransmit the data to other user systems as ARINC 429 general broadcast data. One ARINC 429 input on the DFDAU can be programmed to receive this data.

8.4.2 DFDAU Interface With an ARINC 739 "Multi-Function Control/Display Unit"

¢-7

As an alternative to a dedicated FDEP, the DFDAU may be configured to interface with an MCDU. In this configuration, the DFDAU should contain an ARINC 429 transmitter, and programming to provide for File Data Transfer using the protocol specified in ARINC Characteristic 739 and ARINC 429. This alternative permits the DFDAU designer to duplicate other capabilities of an FDEP such as data display and status reporting, thus reducing or eliminating the need for a display unit as part of ground support equipment.

9.0 PROVISIONS FOR AUTOMATIC TEST EQUIPMENT

9.1 General

To enable Automatic Test Equipment (ATE) to be used in the bench maintenance of the ARINC 717 DEFDARS, those internal circuit functions not available at the service connector inserts and considered by equipment manufacturers to be needed for automatic test purposes should be brought to the ATE connector. The connector should be provided with a protective cover suitable to protect these pins from damage, contamination, etc. while the unit is installed in the aircraft.

9.2 Unit Identification

Six pins on a service insert should be reserved for the implementation of a "resistance coding" scheme for unit identification by the ATE, in which a 1% tolerance resistor is connected from each pin to common ground in ¢-1 a "star" formation. Values selected should correspond to the standard 10% increments in resistance in order to prevent ambiguities resulting from tolerance build-up and aging. the power handling capability of each resistor need not exceed 0.1 watt.

9.2.1 Pin Allocation

Two pins should be allocated to each of the following functions and one pin to the "star formation common" (i.e., DC chassis ground).

LTP2A-LTP2B	Manufacturer Identification (Resistor values to be registered with ARINC when selected)
LTP2C-LTP2D ¢-1	Part No. or Type No. of the equipment
LTP2E-LTP2F	Modification Status of the Equipment
LTP2G	Network common (Resistor "star" point)

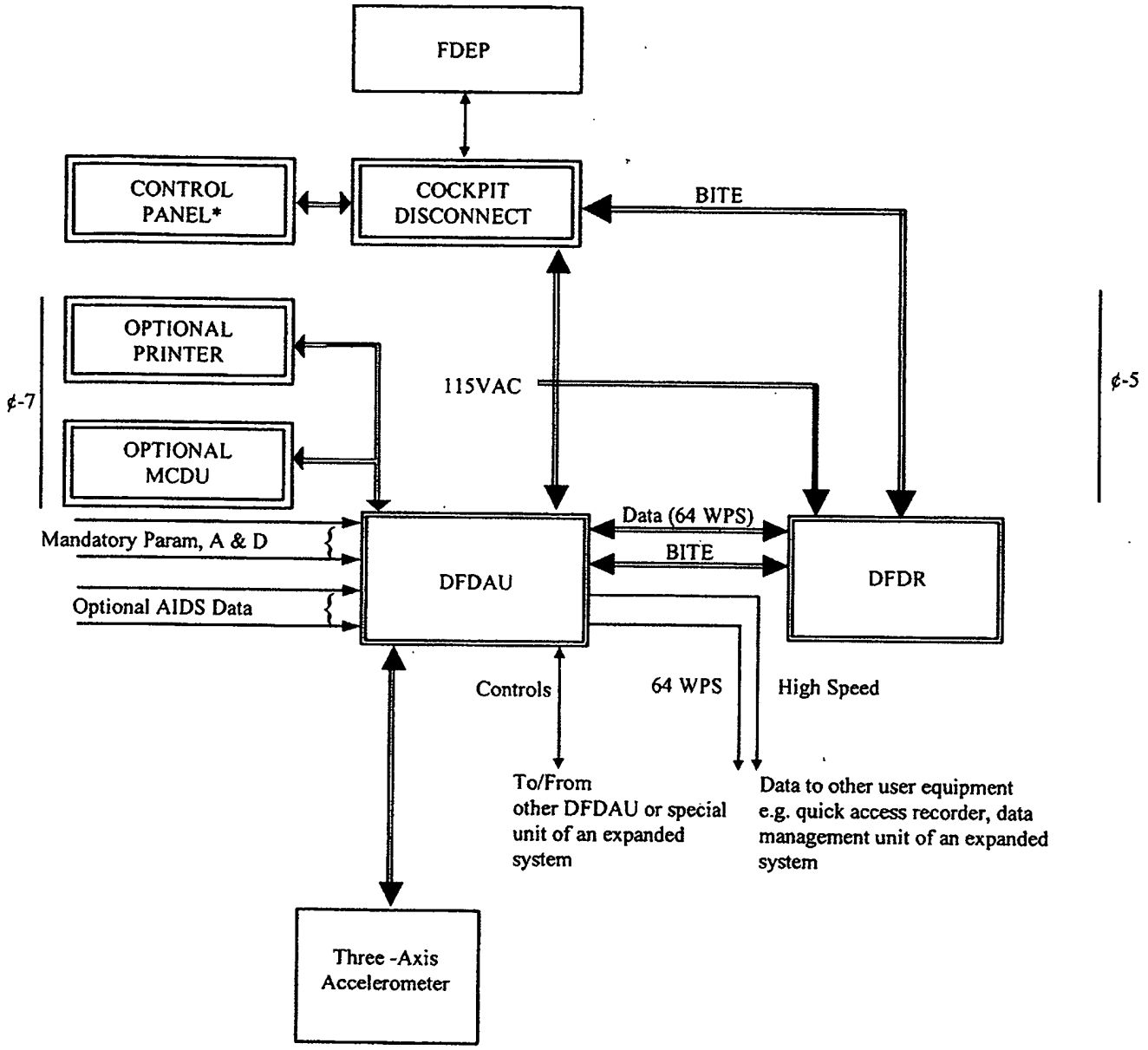
IMPORTANT NOTE:

Resistor codes for manufacturer identification will be recorded by ARINC in order to prevent duplication. Such registration, however, should not be confused with assignment. It is the responsibility of each manufacturer to select a code and inform ARINC of his choice. Code assignments for equipment part number and modification status are entirely the province of the manufacturer and do not require registration with ARINC.

9.2.2 Use of ATLAS Language

Equipment manufacturers should note that the airlines ¢-2 desire to have the DEFDARS test procedures intended for execution by automatic test equipment written in the ATLAS language described in ARINC Specification 616.

ATTACHMENT 1
SYSTEM BLOCK DIAGRAM

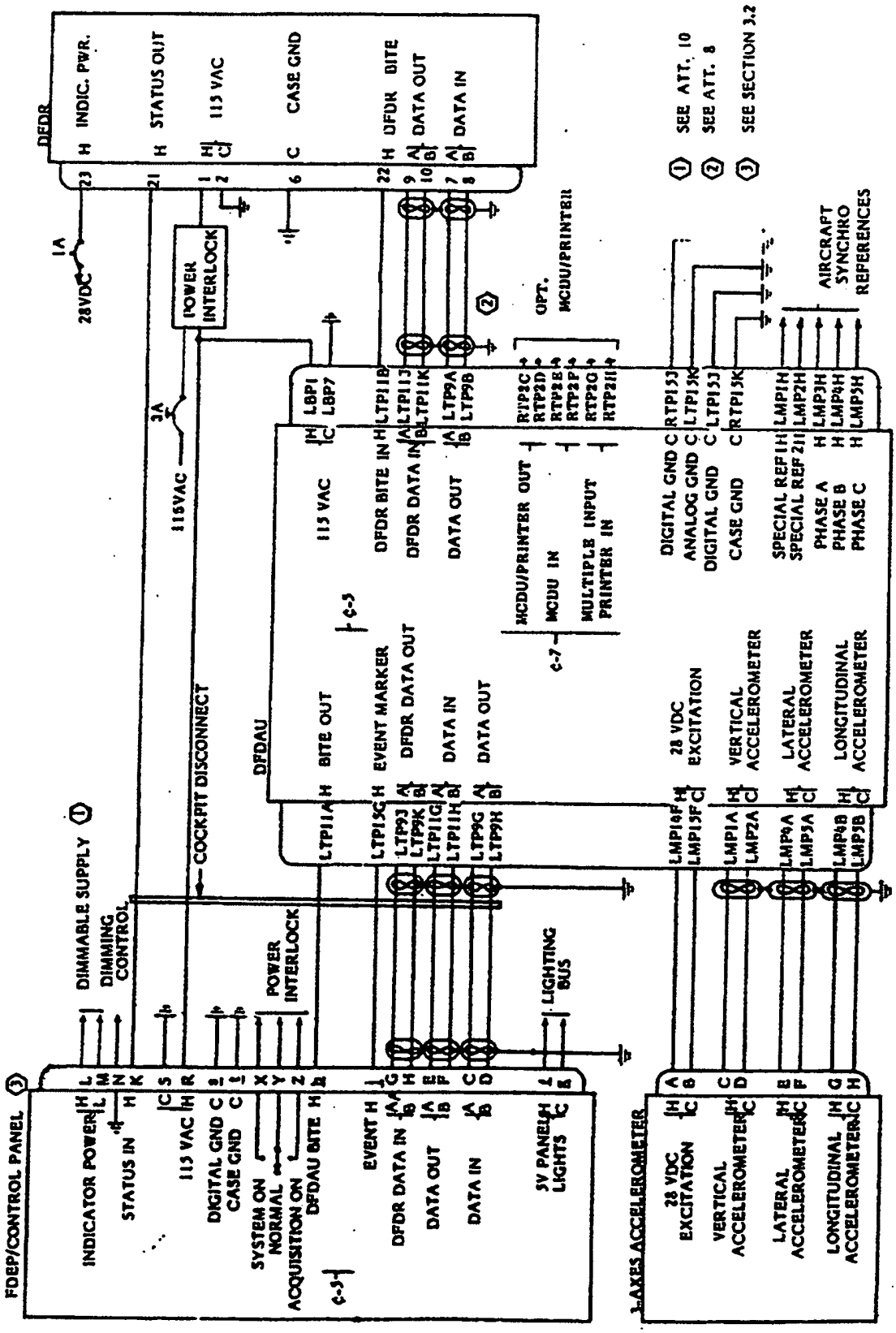


Double boxed units are part of the minimum system

Double lines form the standard interwiring

* May be combined with the FDEP, if installed

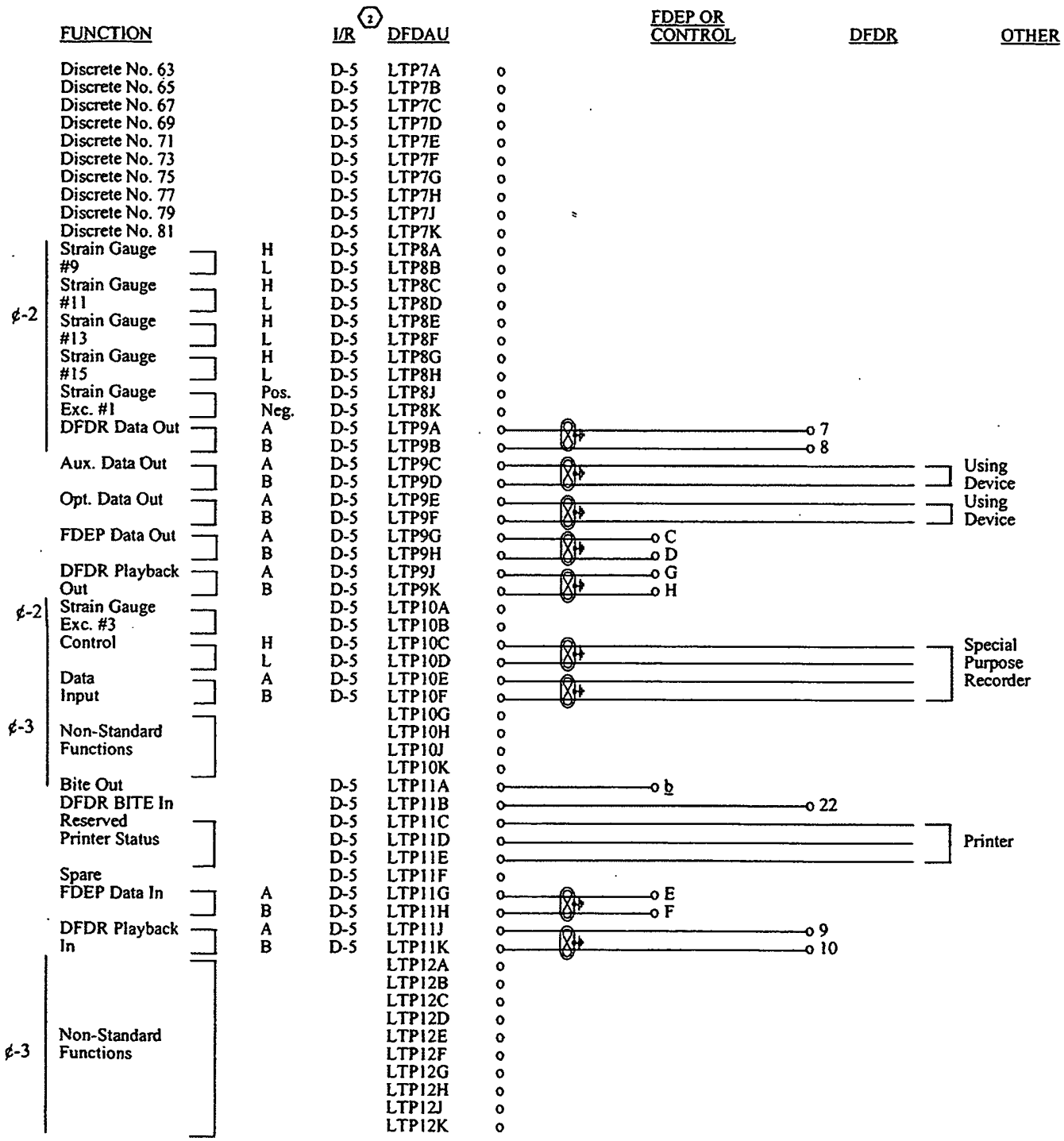
ATTACHMENT 2-1
SYSTEM STANDARD INTERWIRING



ATTACHMENT 2-2
DFDAU STANDARD INTERWIRING

	FUNCTION		I/R (2)	DFDAU	FDEP OR CONTROL	DFDR	OTHER
	Discrete No. 3		D-5	LTP1A	o		
	Discrete No. 5		D-5	LTP1B	o		
	Discrete No. 7		D-5	LTP1C	o		
	Discrete No. 9		D-5	LTP1D	o		
	Discrete No. 11		D-5	LTP1E	o		
	Discrete No. 13		D-5	LTP1F	o		
	Discrete No. 15		D-5	LTP1G	o		
	Discrete No. 17		D-5	LTP1H	o		
	Discrete No. 19		D-5	LTP1J	o		
	Discrete No. 21		D-5	LTP1K	o		
	ATE ID			LTP2A	o		
				LTP2B	o		
				LTP2C	o		
				LTP2D	o		
				LTP2E	o		
				LTP2F	o		
				LTP2G	o		
	Ground/Air Discrete	(3)		LTP2H	o		
¢-3	Frame	H	D-5	LTP2J	o		Special Purpose Recorder
¢-3	Sync	L	D-5	LTP2K	o		Special Purpose Recorder
	Discrete No. 23		D-5	LTP3A	o		
	Discrete No. 25		D-5	LTP3B	o		
	Discrete No. 27		D-5	LTP3C	o		
	Discrete No. 29		D-5	LTP3D	o		
	Discrete No. 31		D-5	LTP3E	o		
	Discrete No. 33		D-5	LTP3F	o		
	Discrete No. 35		D-5	LTP3G	o		
	Discrete No. 37		D-5	LTP3H	o		
	Discrete No. 39		D-5	LTP3J	o		
	Discrete No. 41		D-5	LTP3K	o		
	Thermocouple #1	Chromel	D-5	LTP4A	o		
		Alumel	D-5	LTP4B	o		
	Thermocouple #3	Chromel	D-5	LTP4C	o		
		Alumel	D-5	LTP4D	o		
¢-2	Thermocouple #5	Chromel	D-5	LTP4E	o		
¢-2		Alumel	D-5	LTP4F	o		
	Thermocouple #7	Chromel	D-5	LTP4G	o		
		Alumel	D-5	LTP4H	o		
	Thermocouple #9	Chromel	D-5	LTP4J	o		
		Alumel	D-5	LTP4K	o		
	Discrete No. 43		D-5	LTP5A	o		
	Discrete No. 45		D-5	LTP5B	o		
	Discrete No. 47		D-5	LTP5C	o		
	Discrete No. 49		D-5	LTP5D	o		
	Discrete No. 51		D-5	LTP5E	o		
	Discrete No. 53		D-5	LTP5F	o		
	Discrete No. 55		D-5	LTP5G	o		
	Discrete No. 57		D-5	LTP5H	o		
	Discrete No. 59		D-5	LTP5J	o		
	Discrete No. 61		D-5	LTP5K	o		
	Thermocouple #11	Chromel	D-5	LTP6A	o		
		Alumel	D-5	LTP6B	o		
	Strain Gauge #1	H	D-5	LTP6C	o		
		L	D-5	LTP6D	o		
¢-2	Strain Gauge #3	H	D-5	LTP6E	o		
¢-2		L	D-5	LTP6F	o		
	Strain Gauge #5	H	D-5	LTP6G	o		
		L	D-5	LTP6H	o		
	Strain Gauge #7	H	D-5	LTP6J	o		
		L	D-5	LTP6K	o		

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING



ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

	FUNCTION		I/R (2)	DFDAU	FDEP OR CONTROL	DFDR	OTHER
	DITS Port No. 1	A	D-5	LTP13A			DITS
		B	D-5	LTP13B			Source
	DITS Port No. 3	A	D-5	LTP13C			DITS
		B	D-5	LTP13D			Source
	DITS Port No. 5	A	D-5	LTP13E			DITS
		B	D-5	LTP13F			Source
	DITS Port No. 7	A	D-5	LTP13G			DITS
		B	D-5	LTP13H			Source
	DITS Port No. 9	A	D-5	LTP13J			DITS
		B	D-5	LTP13K			Source
	DITS Port No. 11	A	D-5	LTP14A			DITS
		B	D-5	LTP14B			Source
	DITS Port No. 13	A	D-5	LTP14C			DITS
	High/Low Speed	B	D-5	LTP14D			Source
	DITS Port No. 15	A	D-5	LTP14E			DITS
	High/Low Speed	B	D-5	LTP14F			Source
	Reserved	A	D-5	LTP14G			
	DITS Port No. 17	B	D-5	LTP14H			
	Reserved	A	D-5	LTP14J			
	DITS Port No. 19	B	D-5	LTP14K			
	Reserved	A	D-5	LTP15A			
	DITS Port No. 21	B	D-5	LTP15B			
	Reserved	A	D-5	LTP15C			
	DITS Port No. 23	B	D-5	LTP15D			
	Reserved	A		LTP15E			
	Digital Output	B		LTP15F			
	Discrete No. 1		D-5	LTP15G			
	Opt. control.(QAR)		D-5	LTP15H			QAR
	Digital Ground		D-5	LTP15J			
	Analog Ground		D-5	LTP15K			
	Discrete No. 2		D-5	RTP1A	o		
	Discrete No. 4		D-5	RTP1B	o		
	Discrete No. 6		D-5	RTP1C	o		
	Discrete No. 8		D-5	RTP1D	o		
	Discrete No. 10		D-5	RTP1E	o		
	Discrete No. 12		D-5	RTP1F	o		
	Discrete No. 14		D-5	RTP1G	o		
	Discrete No. 16		D-5	RTP1H	o		
	Discrete No. 18		D-5	RTP1J	o		
	Discrete No. 20		D-5	RTP1K	o		
	Reserved (Control)			RTP2A	o		
	Reserved (Control)			RTP2B	o		
¢-8	Reserved	A	D-5	RTP2C	o		
	MCDU/Printer Out	B	D-5	RTP2D	o		
¢-9	MCDU #1	A	D-5	RTP2E	o		
	MCDU #1	B	D-5	RTP2F	o		
¢-8	Reserved	A	D-5	RTP2G	o		
	429 Printer Input	B	D-5	RTP2H	o		
¢-9	MCDU #2	A	D-5	RTP2J	o		
	MCDU #2	B	D-5	RTP2K	o		
	Discrete No. 22		D-5	RTP3A	o		
	Discrete No. 24		D-5	RTP3B	o		
	Discrete No. 26		D-5	RTP3C	o		
	Discrete No. 28		D-5	RTP3D	o		
	Discrete No. 30		D-5	RTP3E	o		
	Discrete No. 32		D-5	RTP3F	o		
	Discrete No. 34		D-5	RTP3G	o		
	Discrete No. 36		D-5	RTP3H	o		
	Discrete No. 38		D-5	RTP3J	o		
	Discrete No. 40		D-5	RTP3K	o		

REVISED: July 29, 1980

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

	FUNCTION		I/R ②	DFDAU		FDEP OR CONTROL	DFDR	OTHER
	Thermocouple #2	Chromel	D-5	RTP4A	o			
		Alumel	D-5	RTP4B	o			
	Thermocouple #4	Chromel	D-5	RTP4C	o			
		Alumel	D-5	RTP4D	o			
¢-2	Thermocouple #6	Chromel	D-5	RTP4E	o			
		Alumel	D-5	RTP4F	o			
	Thermocouple #8	Chromel	D-5	RTP4G	o			
		Alumel	D-5	RTP4H	o			
	Thermocouple #10	Chromel	D-5	RTP4J	o			
		Alumel	D-5	RTP4K	o			
	Discrete No. 42		D-5	RTP5A	o			
	Discrete No. 44		D-5	RTP5B	o			
	Discrete No. 46		D-5	RTP5C	o			
	Discrete No. 48		D-5	RTP5D	o			
	Discrete No. 50		D-5	RTP5E	o			
	Discrete No. 52		D-5	RTP5F	o			
	Discrete No. 54		D-5	RTP5G	o			
	Discrete No. 56		D-5	RTP5H	o			
	Discrete No. 58		D-5	RTP5J	o			
	Discrete No. 60		D-5	RTP5K	o			
	Thermocouple #12	Chromel	D-5	RTP6A	o			
		Alumel	D-5	RTP6B	o			
	Strain Gauge #2	H	D-5	RTP6C	o			
		L	D-5	RTP6D	o			
¢-2	Strain Gauge #4	H	D-5	RTP6E	o			
		L	D-5	RTP6F	o			
	Strain Gauge #6	H	D-5	RTP6G	o			
		L	D-5	RTP6H	o			
	Strain Gauge #8	H	D-5	RTP6J	o			
		L	D-5	RTP6K	o			
	Discrete No. 62		D-5	RTP7A	o			
	Discrete No. 64		D-5	RTP7B	o			
	Discrete No. 66		D-5	RTP7C	o			
	Discrete No. 68		D-5	RTP7D	o			
	Discrete No. 70		D-5	RTP7E	o			
	Discrete No. 72		D-5	RTP7F	o			
	Discrete No. 74		D-5	RTP7G	o			
	Discrete No. 76		D-5	RTP7H	o			
	Discrete No. 78		D-5	RTP7J	o			
	Discrete No. 80		D-5	RTP7K	o			
	Strain Gauge #10	H	D-5	RTP8A	o			
		L	D-5	RTP8B	o			
	Strain Gauge #12	H	D-5	RTP8C	o			
		L	D-5	RTP8D	o			
¢-2	Strain Gauge #14	H	D-5	RTP8E	o			
		L	D-5	RTP8F	o			
	Strain Gauge #16	H	D-5	RTP8G	o			
		L	D-5	RTP8H	o			
	Strain Gauge Exc. #2	Pos	D-5	RTP8J	o			
		Neg	D-5	RTP8K	o			
	Aircraft Type Identification		D-5	RTP9A	o———			
			D-5	RTP9B	o———			
			D-5	RTP9C	o———			
			D-5	RTP9D	o———			
			D-5	RTP9E	o———			
			D-5	RTP9F	o———			
	Fleet Identification		D-5	RTP9G	o———			
			D-5	RTP9H	o———			
			D-5	RTP9J	o———			
			D-5	RTP9K	o———			

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

	FUNCTION		I/R (2)	DFDAU	FDEP OR FDEP OR CONTROL	DFDR	OTHER
¢-2	Strain Gauge	Pos	D-5	RTP10A	o		
	Exc. #4	Neg	D-5	RTP10B	o		
	Spare		D-5	RTP10C	o		
	Spare		D-5	RTP10D	o		
	Reserved	A	D-5	RTP10E	o		
	DITS Port No. 25	B	D-5	RTP10F	o		
¢-4	Reserved	A	D-5	RTP10G	o		
	DITS Port No. 26	B	D-5	RTP10H	o		
	Reserved	A	D-5	RTP10J	o		
	DITS Port No. 27	B	D-5	RTP10K	o		
			D-5	RTP11A	o		
			D-5	RTP11B	o		
			D-5	RTP11C	o		
	Aircraft		D-5	RTP11D	o		
	Number		D-5	RTP11E	o		
	Identification		D-5	RTP11F	o		
			D-5	RTP11G	o		
			D-5	RTP11H	o		
¢-10	Aircraft Type Ident			RTP11J	o		
	Identification Common			RTP11K	o		
	Reserved	A	D-5	RTP12A	o		
	DITS Port No. 28	B	D-5	RTP12B	o		
	Reserved	A	D-5	RTP12C	o		
	DITS Port No. 29	B	D-5	RTP12D	o		
	Reserved	A	D-5	RTP12E	o		
¢-4	DITS Port No. 30	B	D-5	RTP12F	o		
	Reserved	A	D-5	RTP12G	o		
	DITS Port No. 31	B	D-5	RTP12H	o		
	Reserved	A	D-5	RTP12J	o		
	DITS Port No. 32	B	D-5	RTP12K			
	DITS Port No. 2	A	D-5	RTP13A	o		DITS
		B	D-5	RTP13B	o		Source
	DITS Port No. 4	A	D-5	RTP13C	o		DITS
		B	D-5	RTP13D	o		Source
	DITS Port No. 6	A	D-5	RTP13E	o		DITS
		B	D-5	RTP13F	o		Source
	DITS Port No. 8	A	D-5	RTP13G	o		DITS
		B	D-5	RTP13H	o		Source
	DITS Port No. 10	A	D-5	RTP13J	o		DITS
		B	D-5	RTP13K	o		Source
	DITS Port No. 12	A	D-5	RTP14A	o		DITS
		B	D-5	RTP14B	o		Source
	DITS Port No. 14	A	D-5	RTP14C	o		DITS
	High/Low Speed	B	D-5	RTP14D	o		Source
	DITS Port No. 16	A	D-5	RTP14E	o		DITS
	High/Low Speed	B	D-5	RTP14F	o		Source
	Reserved	A	D-5	RTP14G	o		
	DITS Port No. 18	B	D-5	RTP14H	o		
	Reserved	A	D-5	RTP14J	o		
	DITS Port No. 20	B	D-5	RTP14K	o		
	Reserved	A	D-5	RTP15A	o		
	DITS Port No. 22	B	D-5	RTP15B	o		
	Reserved	A	D-5	RTP15C	o		
	DITS Port No. 24	B	D-5	RTP15D	o		
	Reserved	A	D-5	RTP15E	o		
	Printer Data Out	B	D-5	RTP15F	o		
¢-5	Spare		D-5	RTP15G	o		
	Spare		D-5	RTP15H	o		
	Digital Ground		D-5	RTP15J	o		
	Case Ground		D-0.1	RTP15K	o		

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

FUNCTION		I/R (2)	DFDAU	FDEP OR CONTROL	DFDR	OTHER
Analog Input No. 1	a (1)	D-5	LMP1A	o		Vert. Acc. H
Analog Input No. 11	a	D-5	LMP1B	o		
Analog Input No. 21	a	D-5	LMP1C	o		
Analog Input No. 31	a	D-5	LMP1D	o		
Analog Input No. 41	a	D-5	LMP1E	o		
Analog Input No. 49	a	D-5	LMP1F	o		
Analog Input No. 55	a	D-5	LMP1G	o		
Synchro Ref. 1		D-5	LMP1H	o		Synchro Ref.
Analog Input No. 65	a	D-5	LMP1J	o		
Analog Input No. 75	a	D-5	LMP1K	o		
Analog Input No. 1	b	D-5	LMP2A	o		Vert. Acc. L
Analog Input No. 11	b	D-5	LMP2B	o		
Analog Input No. 21	b	D-5	LMP2C	o		
Analog Input No. 31	b	D-5	LMP2D	o		
Analog Input No. 41	b	D-5	LMP2E	o		
Analog Input No. 49	b	D-5	LMP2F	o		
Analog Input No. 55	b	D-5	LMP2G	o		
Synchro Ref. 2		D-5	LMP2H	o		Synchro Ref.
Analog Input No. 65	b	D-5	LMP2J	o		
Analog Input No. 75	b	D-5	LMP2K	o		
Analog Input No. 1	c	D-5	LMP3A	o		
Analog Input No. 11	c	D-5	LMP3B	o		
Analog Input No. 21	c	D-5	LMP3C	o		
Analog Input No. 31	c	D-5	LMP3D	o		
Analog Input No. 41	c	D-5	LMP3E	o		
Analog Input No. 49	c	D-5	LMP3F	o		
Analog Input No. 55	c	D-5	LMP3G	o		
Synchro Ref. Phase A		D-5	LMP3H	o		Synchro Phase A
Analog Input No. 65	c	D-5	LMP3J	o		
Analog Input No. 75	c	D-5	LMP3K	o		
Analog Input No. 3	a	D-5	LMP4A	o		Lat. Acc. H
Analog Input No. 13	a	D-5	LMP4B	o		Long. Acc. H
Analog Input No. 23	a	D-5	LMP4C	o		
Analog Input No. 33	a	D-5	LMP4D	o		
Analog Input No. 43	a	D-5	LMP4E	o		
Analog Input No. 49	d	D-5	LMP4F	o		
Analog Input No. 55	d	D-5	LMP4G	o		
Synchro Ref. Phase B		D-5	LMP4H	o		Synchro Phase B
Analog Input No. 67	a	D-5	LMP4J	o		
Analog Input No. 77	a	D-5	LMP4K	o		
Analog Input No. 3	b	D-5	LMP5A	o		Lat. Acc. L
Analog Input No. 13	b	D-5	LMP5B	o		Long. Acc. L
Analog Input No. 23	b	D-5	LMP5C	o		
Analog Input No. 33	b	D-5	LMP5D	o		
Analog Input No. 43	b	D-5	LMP5E	o		
Analog Input No. 51	a	D-5	LMP5F	o		
Analog Input No. 57	a	D-5	LMP5G	o		
Synchro Ref. Phase C		D-5	LMP5H	o		Synchro Phase C
Analog Input No. 67	b	D-5	LMP5J	o		
Analog Input No. 77	b	D-5	LMP5K	o		
Analog Input No. 3	c	D-5	LMP6A	o		
Analog Input No. 13	c	D-5	LMP6B	o		
Analog Input No. 23	c	D-5	LMP6C	o		
Analog Input No. 33	c	D-5	LMP6D	o		
Analog Input No. 43	c	D-5	LMP6E	o		
Analog Input No. 51	b	D-5	LMP6F	o		
Analog Input No. 57	b	D-5	LMP6G	o		
Spare		D-5	LMP6H	o		
Analog Input No. 67	c	D-5	LMP6J	o		
Analog Input No. 77	c	D-5	LMP6K	o		

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

FUNCTION		I/R (2)	DFDAU	FDEP OR CONTROL	DFDR	OTHER
Analog Input No. 5	a	D-5	LMP7A	o———		
Analog Input No. 15	a	D-5	LMP7B	o———		
Analog Input No. 25	a	D-5	LMP7C	o———		
Analog Input No. 35	a	D-5	LMP7D	o———		
Analog Input No. 45	a	D-5	LMP7E	o———		
Analog Input No. 51	c	D-5	LMP7F	o———		
Analog Input No. 57	c	D-5	LMP7G	o———		
Spare			LMP7H	o		
Analog Input No. 69	a	D-5	LMP7J	o———		
Analog Input No. 79	a	D-5	LMP7K	o———		
Analog Input No. 5	b	D-5	LMP8A	o———		
Analog Input No. 15	b	D-5	LMP8B	o———		
Analog Input No. 25	b	D-5	LMP8C	o———		
Analog Input No. 35	b	D-5	LMP8D	o———		
Analog Input No. 45	b	D-5	LMP8E	o———		
Analog Input No. 51	d	D-5	LMP8F	o———		
Analog Input No. 57	d	D-5	LMP8G	o———		
Spare			LMP8H	o		
Analog Input No. 69	b	D-5	LMP8J	o———		
Analog Input No. 79	b	D-5	LMP8K	o———		
Analog Input No. 5	c	D-5	LMP9A	o———		
Analog Input No. 15	c	D-5	LMP9B	o———		
Analog Input No. 25	c	D-5	LMP9C	o———		
Analog Input No. 35	c	D-5	LMP9D	o———		
Analog Input No. 45	c	D-5	LMP9E	o———		
Analog Input No. 53	a	D-5	LMP9F	o———		
Analog Input No. 59	a	D-5	LMP9G	o———		
Spare			LMP9H	o———		
Analog Input No. 69	c	D-5	LMP9J	o———		
Analog Input No. 79	c	D-5	LMP9K	o———		
Analog Input No. 7	a	D-5	LMP10A	o———		
Analog Input No. 17	a	D-5	LMP10B	o———		
Analog Input No. 27	a	D-5	LMP10C	o———		
Analog Input No. 37	a	D-5	LMP10D	o———		
Analog Input No. 47	d	D-5	LMP10E	o———		
Analog Input No. 53	b	D-5	LMP10F	o———		
Analog Input No. 59	b	D-5	LMP10G	o———		
Spare			LMP10H	o		
Analog Input No. 71	a	D-5	LMP10J	o———		
Analog Input No. 81	a	D-5	LMP10K	o———		
Analog Input No. 7	b	D-5	LMP11A	o———		
Analog Input No. 17	b	D-5	LMP11B	o———		
Analog Input No. 27	b	D-5	LMP11C	o———		
Analog Input No. 37	b	D-5	LMP11D	o———		
Analog Input No. 47	a	D-5	LMP11E	o———		
Analog Input No. 53	c	D-5	LMP11F	o———		
Analog Input No. 59	c	D-5	LMP11G	o———		
Spare			LMP11H	o		
Analog Input No. 71	b	D-5	LMP11J	o———		
Analog Input No. 81	b	D-5	LMP11K	o———		
Analog Input No. 7	c	D-5	LMP12A	o———		
Analog Input No. 17	c	D-5	LMP12B	o———		
Analog Input No. 27	c	D-5	LMP12C	o———		
Analog Input No. 37	c	D-5	LMP12D	o———		
Analog Input No. 47	b	D-5	LMP12E	o———		
Analog Input No. 53	d	D-5	LMP12F	o———		
Analog Input No. 59	d	D-5	LMP12G	o———		
Spare			LMP12H	o		
Analog Input No. 71	c	D-5	LMP12J	o———		
Analog Input No. 81	c	D-5	LMP12K	o———		

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

FUNCTION		I/R (2)	DFDAU	FDEP OR CONTROL	DFDR	OTHER
Analog Input No. 9	a	D-5	LMP13A			
Analog Input No. 19	a	D-5	LMP13B			
Analog Input No. 29	a	D-5	LMP13C			
Analog Input No. 39	a	D-5	LMP13D			
Analog Input No. 47	c	D-5	LMP13E			
Spare			LMP13F			
Analog Input No. 61	a	D-5	LMP13G			
Analog Input No. 63	a	D-5	LMP13H			
Analog Input No. 73	a	D-5	LMP13J			
Analog Input No. 83	a	D-5	LMP13K			
Analog Input No. 9	b	D-5	LMP14A			
Analog Input No. 19	b	D-5	LMP14B			
Analog Input No. 29	b	D-5	LMP14C			
Analog Input No. 39	b	D-5	LMP14D			
Analog Input No. 47	d	D-5	LMP14E			
Accelerometer Exc.	H	D-5	LMP14F			Accel. Exc.
Analog Input No. 61	b	D-5	LMP14G			
Analog Input No. 63	b	D-5	LMP14H			
Analog Input No. 73	b	D-5	LMP14J			
Analog Input No. 83	b	D-5	LMP14K			
Analog Input No. 9	c	D-5	LMP15A			
Analog Input No. 19	c	D-5	LMP15B			
Analog Input No. 29	c	D-5	LMP15C			
Analog Input No. 39	c	D-5	LMP15D			
Probe Exc. Return	c	D-5	LMP15E			
Accelerometer Exc.	C	D-5	LMP15F			Accel. Exc.
Analog Input No. 61	c	D-5	LMP15G			
Analog Input No. 63	c	D-5	LMP15H			
Analog Input No. 73	c	D-5	LMP15J			
Analog Input No. 83	c	D-5	LMP15K			
Analog Input No. 2	a	D-5	RMP1A			
Analog Input No. 12	a	D-5	RMP1B			
Analog Input No. 22	a	D-5	RMP1C			
Analog Input No. 32	a	D-5	RMP1D			
Analog Input No. 42	a	D-5	RMP1E			
Analog Input No. 50	a	D-5	RMP1F			
Analog Input No. 56	a	D-5	RMP1G			
RESERVED (File In)	A	D-5	RMP1H			
Analog Input No. 66	a	D-5	RMP1J			
Analog Input No. 76	a	D-5	RMP1K			
Analog Input No. 2	b	D-5	RMP2A			
Analog Input No. 12	b	D-5	RMP2B			
Analog Input No. 22	b	D-5	RMP2C			
Analog Input No. 32	b	D-5	RMP2D			
Analog Input No. 42	b	D-5	RMP2E			
Analog Input No. 50	b	D-5	RMP2F			
Analog Input No. 56	b	D-5	RMP2G			
RESERVED (File In)	B	D-5	RMP2H			
Analog Input No. 66	b	D-5	RMP2J			
Analog Input No. 76	b	D-5	RMP2K			
Analog Input No. 2	c	D-5	RMP3A			
Analog Input No. 12	c	D-5	RMP3B			
Analog Input No. 22	c	D-5	RMP3C			
Analog Input No. 32	c	D-5	RMP3D			
Analog Input No. 42	c	D-5	RMP3E			
Analog Input No. 50	c	D-5	RMP3F			
Analog Input No. 56	c	D-5	RMP3G			
RESERVED (File Out)	A	D-5	RMP3H			
Analog Input No. 66	c	D-5	RMP3J			
Analog Input No. 76	c	D-5	RMP3K			

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

	FUNCTION		I/R ①	DFDAU	FDEP OR CONTROL	DFDR	OTHER
	Analog Input No. 4	a	D-5	RMP4A			
	Analog Input No. 14	a	D-5	RMP4B			
	Analog Input No. 24	a	D-5	RMP4C			
	Analog Input No. 34	a	D-5	RMP4D			
	Analog Input No. 44	a	D-5	RMP4E			
	Analog Input No. 50	d	D-5	RMP4F			
	Analog Input No. 56	d	D-5	RMP4G			
	RESERVED (File Out)	B	D-5	RMP4H			
	Analog Input No. 68	a	D-5	RMP4J			
	Analog Input No. 78	a	D-5	RMP4K			
	Analog Input No. 4	b	D-5	RMP5A			
	Analog Input No. 14	b	D-5	RMP5B			
	Analog Input No. 24	b	D-5	RMP5C			
	Analog Input No. 34	b	D-5	RMP5D			
	Analog Input No. 44	b	D-5	RMP5E			
	Analog Input No. 52	a	D-5	RMP5F			
	Analog Input No. 58	a	D-5	RMP5G			
¢-9 |	Optional Data Output No. 2	a	D-5	RMP5H			
	Analog Input No. 68	b	D-5	RMP5J			
	Analog Input No. 78	b	D-5	RMP5K			
	Analog Input No. 4	c	D-5	RMP6A			
	Analog Input No. 14	c	D-5	RMP6B			
	Analog Input No. 24	c	D-5	RMP6C			
	Analog Input No. 34	c	D-5	RMP6D			
	Analog Input No. 44	c	D-5	RMP6E			
	Analog Input No. 52	b	D-5	RMP6F			
	Analog Input No. 58	b	D-5	RMP6G			
¢-9 |	Optional Data Output No. 2	b	D-5	RMP6H			
	Analog Input No. 68	c	D-5	RMP6J			
	Analog Input No. 78	c	D-5	RMP6K			
	Analog Input No. 6	a	D-5	RMP7A			
	Analog Input No. 16	a	D-5	RMP7B			
	Analog Input No. 26	a	D-5	RMP7C			
	Analog Input No. 36	a	D-5	RMP7D			
	Analog Input No. 46	a	D-5	RMP7E			
	Analog Input No. 52	c	D-5	RMP7F			
	Analog Input No. 58	c	D-5	RMP7G			
¢-9 |	Data Ldr. Input	a	D-5	RMP7H			
	Analog Input No. 70	a	D-5	RMP7J			
	Analog Input No. 80	a	D-5	RMP7K			
	Analog Input No. 6	b	D-5	RMP8A			
	Analog Input No. 16	b	D-5	RMP8B			
	Analog Input No. 26	b	D-5	RMP8C			
	Analog Input No. 36	b	D-5	RMP8D			
	Analog Input No. 46	b	D-5	RMP8E			
	Analog Input No. 52	d	D-5	RMP8F			
	Analog Input No. 58	d	D-5	RMP8G			
¢-9 |	Data Ldr. Input	b	D-5	RMP8H			
	Analog Input No. 70	b	D-5	RMP8J			
	Analog Input No. 80	b	D-5	RMP8K			
	Analog Input No. 6	c	D-5	RMP9A			
	Analog Input No. 16	c	D-5	RMP9B			
	Analog Input No. 26	c	D-5	RMP9C			
	Analog Input No. 36	c	D-5	RMP9D			
	Analog Input No. 46	c	D-5	RMP9E			
	Analog Input No. 54	a	D-5	RMP9F			
	Analog Input No. 60	a	D-5	RMP9G			
¢-9 |	Data Ldr. Input	a	D-5	RMP9H			
	Analog Input No. 70	c	D-5	RMP9J			
	Analog Input No. 80	c	D-5	RMP9K			

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

	FUNCTION		I/R (2)	DFDAU	FDEP OR CONTROL	DFDR	OTHER
	Analog Input No. 8	a	D-5	RMP10A			
	Analog Input No. 18	a	D-5	RMP10B			
	Analog Input No. 28	a	D-5	RMP10C			
	Analog Input No. 38	a	D-5	RMP10D			
	Analog Input No. 46	d	D-5	RMP10E			
	Analog Input No. 54	b	D-5	RMP10F			
	Analog Input No. 60	b	D-5	RMP10G			
¢-9 |	Data Ldr. Output	b	D-5	RMP10H			
	Analog Input No. 72	a	D-5	RMP10J			
	Analog Input No. 82	a	D-5	RMP10K			
	Analog Input No. 8	b	D-5	RMP11A			
	Analog Input No. 18	b	D-5	RMP11B			
	Analog Input No. 28	b	D-5	RMP11C			
	Analog Input No. 38	b	D-5	RMP11D			
	Analog Input No. 48	a	D-5	RMP11E			
	Analog Input No. 54	c	D-5	RMP11F			
	Analog Input No. 60	c	D-5	RMP11G			
¢-9 |	Data Ldr. Enable Disc.		D-5	RMP11H			
	Analog Input No. 72	b	D-5	RMP11J			
	Analog Input No. 82	b	D-5	RMP11K			
	Analog Input No. 8	c	D-5	RMP12A			
	Analog Input No. 18	c	D-5	RMP12B			
	Analog Input No. 28	c	D-5	RMP12C			
	Analog Input No. 38	c	D-5	RMP12D			
	Analog Input No. 48	b	D-5	RMP12E			
	Analog Input No. 54	d	D-5	RMP12F			
	Analog Input No. 60	d	D-5	RMP12G			
	Spare			RMP12H			
	Analog Input No. 72	c	D-5	RMP12J			
	Analog Input No. 82	c	D-5	RMP12K			
	Analog Input No. 10	a	D-5	RMP13A			
	Analog Input No. 20	a	D-5	RMP13B			
	Analog Input No. 30	a	D-5	RMP13C			
	Analog Input No. 40	a	D-5	RMP13D			
	Analog Input No. 48	c	D-5	RMP13E			
¢-4 |	Potentiometer Sensing		D-5	RMP13F			
	Analog Input No. 62	a	D-5	RMP13G			
	Analog Input No. 64	a	D-5	RMP13H			
	Analog Input No. 74	a	D-5	RMP13J			
	Analog Input No. 84	a	D-5	RMP13K			
	Analog Input No. 10	b	D-5	RMP14A			
	Analog Input No. 20	b	D-5	RMP14B			
	Analog Input No. 30	b	D-5	RMP14C			
	Analog Input No. 40	b	D-5	RMP14D			
	Analog Input No. 48	d	D-5	RMP14E			
¢-4 |	Potentiometer Exc.	H	D-5	RMP14F			
	Analog Input No. 62	b	D-5	RMP14G			
	Analog Input No. 64	b	D-5	RMP14H			
	Analog Input No. 74	b	D-5	RMP14J			
	Analog Input No. 84	b	D-5	RMP14K			
	Analog Input No. 10	c	D-5	RMP15A			
	Analog Input No. 20	c	D-5	RMP15B			
	Analog Input No. 30	c	D-5	RMP15C			
	Analog Input No. 40	c	D-5	RMP15D			
	Probe Exc. Return	c	D-5	RMP15E			
¢-4 |	Potentiometer Exc.	C	D-5	RMP15F			
	Analog Input No. 62	c	D-5	RMP15G			
	Analog Input No. 64	c	D-5	RMP15H			
	Analog Input No. 74	c	D-5	RMP15J			
	Analog Input No. 84	c	D-5	RMP15K			

ATTACHMENT 2-2 (cont'd)
DFDAU STANDARD INTERWIRING

FUNCTION		I/R (2)	DFDAU	COCKPIT DISCONNECT	DFDR	OTHER
115VAC	H	1-0.1	LBP1	o———		To Interlocks
			LBP2	o		
			LBP3	o		
Spare			LBP4	o		
			LBP5	o		
			LBP6	o		
115VAC	C	1-0.1	LBP7	o———		Power Return
			LBP8	o		
			LBP9	o		
Spare			LBP10	o		
			LBP11	o		
			LBP12	o		
			LBP13	o		

RBP Insert is not used.

(1) Pin connection designated by a, b, c and d are as shown in Attachment 5-1.

(2) WIRE TYPES AND SIZES

Wire "Type" and "I-R" needs are set forth in this Characteristic to more accurately define the standard installation. Details on the "Type" of wire which should be used to provide the degree of noise protection needed in the Standard Interwiring are given in Note 2.

The "I-R" values define the maximum current (I) in amperes and effective resistance (R) in ohms for which the installation and equipment should be designed. It is anticipated that installation designers will use these figures, together with the lengths of the cable runs in a given airframe, to calculate the gauge of each wire in the installation. Where their calculations reveal the possibility of using higher gauge numbers then #22 AWG, they are asked to stop and consider whether the mechanical strength of this wire is adequate for the installation before deciding to use it. The airlines report unacceptable experience with this type of wire, and although they are, of course, interested in the weight saving its use affords, they will quickly point out that these savings are rapidly nullified by maintenance costs if frequent breakage occur.

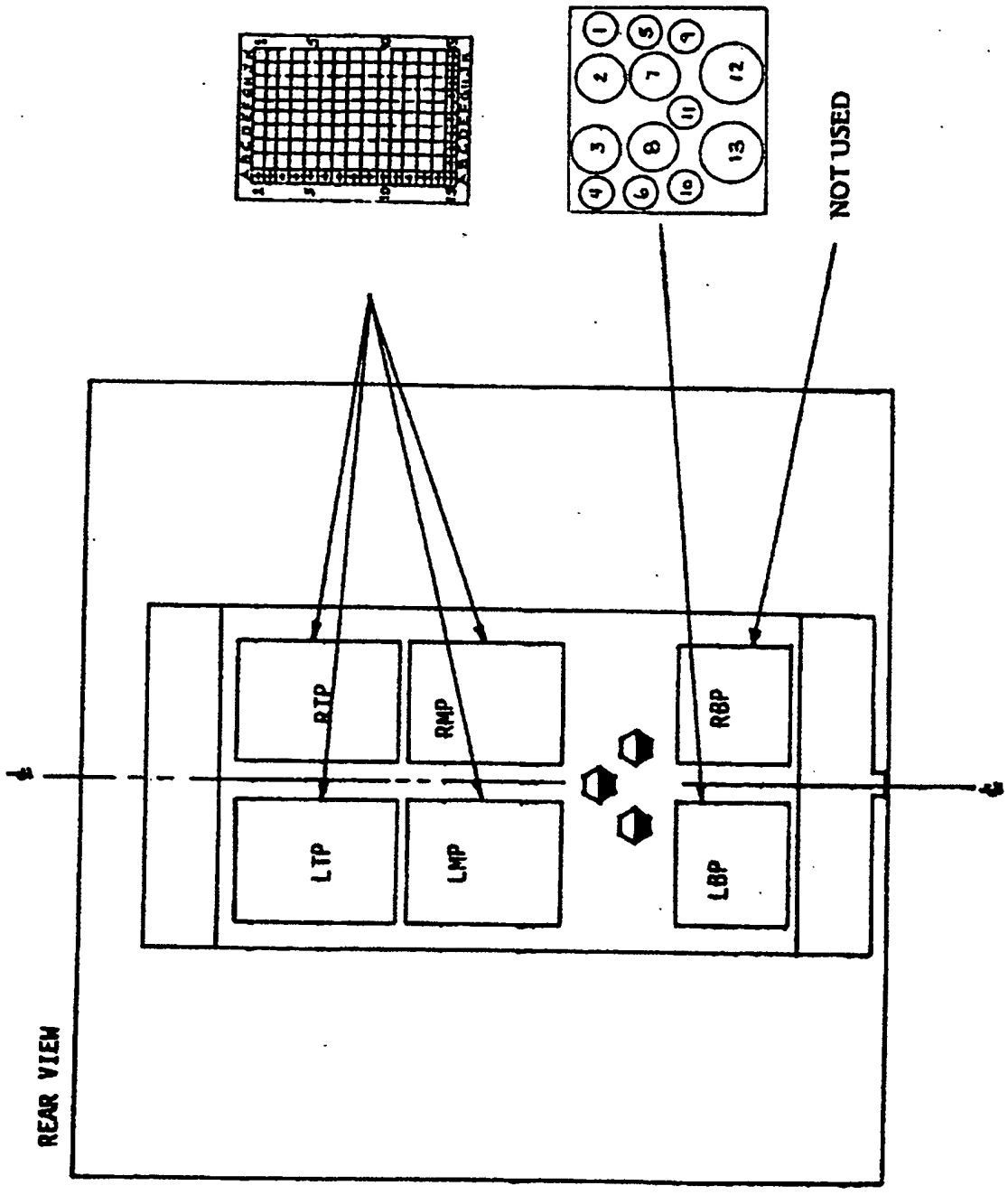
NOTE: Wires for which a "D" symbol is shown in place of a current rating may be used for any function ranging from "Dry Circuits" (hence "D") to 5 ampere applications.

Both installation and equipment designers should give due regard to special cases wherein parallel or series-parallel connected circuits may result in higher currents or voltage drop (effective resistance) than in simple circuits. Unless otherwise noted, the current limit set forth applies to all elements of parallel or series-parallel circuits.

(3) GROUND/AIR DISCRETE INPUT

This pin is assigned to a ground/air logic input to the AIDS for application therein as the user sees fit. It should be wired to a logic source in the aircraft which presents a standard open circuit (100,000 ohms or more resistance from this pin to airframe DC ground or a voltage between 18.5 and 36.0 VDC) while the aircraft is on the ground and a standard ground (less than 10 ohms resistance from the pin to airframe DC ground or a voltage between 0 and + 3.5 VDC) when the aircraft is airborne. Airframe and equipment manufacturers are cautioned to provide sneak circuit protection for this input so that malfunctions of other equipment connected to the same logic do not affect the AIDS operation.

ATTACHMENT 3-1
DFDAU CONNECTOR PLACEMENT



ATTACHMENT 3-2
DFDAU PIN ASSIGNMENT

LIP

	A	B	C	D	E	F	G	H	J	K	
1	DISCRETE NO. 3	DISCRETE NO. 5	DISCRETE NO. 7	DISCRETE NO. 9	DISCRETE NO. 11	DISCRETE NO. 13	DISCRETE NO. 15	DISCRETE NO. 17	DISCRETE NO. 19	DISCRETE NO. 21	
2	ATE IDENTIFICATION						COMMON	GROUND/ AIR DISCRETE	SPECIAL-PURPOSE RECORDER FRAME SYNC		¢-3
3	DISCRETE NO. 23	DISCRETE NO. 25	DISCRETE NO. 27	DISCRETE NO. 29	DISCRETE NO. 31	DISCRETE NO. 33	DISCRETE NO. 35	DISCRETE NO. 37	DISCRETE NO. 39	DISCRETE NO. 41	
4	THERMOCOUPLE #1 CHROMEL ALUMEL		THERMOCOUPLE #3 CHROMEL ALUMEL		THERMOCOUPLE #5 CHROMEL ALUMEL		THERMOCOUPLE #7 CHROMEL ALUMEL		THERMOCOUPLE #9 CHROMEL ALUMEL		¢-2
5	DISCRETE NO. 43	DISCRETE NO. 45	DISCRETE NO. 47	DISCRETE NO. 49	DISCRETE NO. 51	DISCRETE NO. 53	DISCRETE NO. 55	DISCRETE NO. 57	DISCRETE NO. 59	DISCRETE NO. 61	
6	THERMOCOUPLE #11 CHROMEL ALUMEL		STRAIN GAUGE #1 H L		STRAIN GAUGE #3 H L		STRAIN GAUGE #5 H L		STRAIN GAUGE #7 H L		¢-2
7	DISCRETE NO. 63	DISCRETE NO. 65	DISCRETE NO. 67	DISCRETE NO. 69	DISCRETE NO. 71	DISCRETE NO. 73	DISCRETE NO. 75	DISCRETE NO. 77	DISCRETE NO. 79	DISCRETE NO. 81	
8	STRAIN GAUGE #9 H L		STRAIN GAUGE #11 H L		STRAIN GAUGE #13 H L		STRAIN GAUGE #15 H L		STRAIN GAUGE EXC. #1 POS. NEG.		¢-2
9	DFDR DATA OUT		AUX. DATA OUT		OPT. DATA OUT		FDEP DATA OUT		DFDR PLAYBACK OUT		
10	STRAIN GAUGE EXC. #3 POS. NEG.		SPECIAL-PURPOSE RECORDER CONTROL H L			DATA IN A B	NON-STANDARD FUNCTIONS				¢-3
11	BITE OUT	DFDR BITE IN	RESERVED PRINTER STATUS A B C			SPARE	FDEP DATA IN		DFDR PLAYBACK IN		
12	NON-STANDARD FUNCTIONS										¢-3
13	DITS PORT NO. 1		DITS PORT NO. 3		DITS PORT NO. 5		DITS PORT NO. 7		DITS PORT NO. 9		
14	DITS PORT NO. 11		DITS PORT NO. 13 HIGH/LOW SPEED		DITS PORT NO. 15 HIGH/LOW SPEED		RESERVED DITS PORT NO. 17		RESERVED DITS PORT NO. 19		
15	RESERVED DITS PORT NO. 21		RESERVED DITS PORT NO. 23		RESERVED DIGITAL OUTPUT		DISCRETE NO. 1	OPT. CONTROL (QAR)	DIGITAL GROUND	ANALOG GROUND	

REVISED: January 15, 1997

ATTACHMENT 3-2 (cont'd)
DFDAU PIN ASSIGNMENT

RTP

	A	B	C	D	E	F	G	H	J	K	
1	DISCRETE NO. 2	DISCRETE NO. 4	DISCRETE NO. 6	DISCRETE NO. 8	DISCRETE NO. 10	DISCRETE NO. 12	DISCRETE NO. 14	DISCRETE NO. 16	DISCRETE NO. 18	DISCRETE NO. 20	
2	RESERVED OPTIONAL CONTROL		RESERVED MCDU/PRINTER OUTPUT		MCDU 1 INPUT	MCDU 1 OUTPUT	RESERVED MULTIPLE INPUT PRINTER INPUT		MCDU 2 INPUT	MCDU 2 OUTPUT	¢-9
3	DISCRETE NO. 22	DISCRETE NO. 24	DISCRETE NO. 26	DISCRETE NO. 28	DISCRETE NO. 30	DISCRETE NO. 32	DISCRETE NO. 34	DISCRETE NO. 36	DISCRETE NO. 38	DISCRETE NO. 40	
4	THERMOCOUPLE #2 CHROMEL ALUMEL		THERMOCOUPLE #4 CHROMEL ALUMEL		THERMOCOUPLE #6 CHROMEL ALUMEL		THERMOCOUPLE #8 CHROMEL ALUMEL		THERMOCOUPLE #10 CHROMEL ALUMEL		¢-2
5	DISCRETE NO. 42	DISCRETE NO. 44	DISCRETE NO. 46	DISCRETE NO. 48	DISCRETE NO. 50	DISCRETE NO. 52	DISCRETE NO. 54	DISCRETE NO. 56	DISCRETE NO. 58	DISCRETE NO. 60	
6	THERMOCOUPLE #12 CHROMEL ALUMEL		STRAIN GAUGE #2 H L		STRAIN GAUGE #4 H L		STRAIN GAUGE #6 H L		STRAIN GAUGE #8 H L		¢-2
7	DISCRETE NO. 62	DISCRETE NO. 64	DISCRETE NO. 66	DISCRETE NO. 68	DISCRETE NO. 70	DISCRETE NO. 72	DISCRETE NO. 74	DISCRETE NO. 76	DISCRETE NO. 78	DISCRETE NO. 80	
8	STRAIN GAUGE #10 H L		STRAIN GAUGE #12 H L		STRAIN GAUGE #14 H L		STRAIN GAUGE #16 H L		STRAIN GAUGE EXC. #2 POS. NEG.		¢-2
9	AIRCRAFT TYPE IDENTIFICATION						FLEET IDENTIFICATION				
10	STRAIN GAUGE EXC. #4 POS. NEG.		SPARE		RESERVED DITS PORT NO. 25		RESERVED DITS PORT NO. 26		RESERVED DITS PORT NO. 27		¢-4
11	AIRCRAFT NUMBER IDENTIFICATION								AIRCRAFT TYPE IDENT	IDENTIFI-CATION COMMON	¢-10
12	RESERVED DITS PORT NO. 28		RESERVED DITS PORT NO. 29		RESERVED DITS PORT NO. 30		RESERVED DITS PORT NO. 31		RESERVED DITS PORT NO. 32		¢-4
13	DITS PORT NO. 2		DITS PORT NO. 4		DITS PORT NO. 6		DITS PORT NO. 8		DITS PORT NO. 10		
14	DITS PORT NO. 12		DITS PORT NO. 14 HIGH/LOW SPEED		DITS PORT NO. 16 HIGH/LOW SPEED		RESERVED DITS PORT NO. 18		RESERVED DITS PORT NO. 20		
15	RESERVED DITS PORT NO. 22		RESERVED DITS PORT NO. 24		RESERVED PRINTER DATA OUT		SPARE	SPARE	DIGITAL GROUND	CASE GROUND	¢-5

ATTACHMENT 3-2 (cont'd)
DFDAU PIN ASSIGNMENT

LMP

	A	B	C	D	E	F	G	H	J	K
1	ANALOG INPUT NO. 1	ANALOG INPUT NO. 11	ANALOG INPUT NO. 21	ANALOG INPUT NO. 31	ANALOG INPUT NO. 41	ANALOG INPUT NO. 49	ANALOG INPUT NO. 55	SYNCHRO REF 1	ANALOG INPUT NO. 65	ANALOG INPUT NO. 75
2	ANALOG INPUT NO. 1	ANALOG INPUT NO. 11	ANALOG INPUT NO. 21	ANALOG INPUT NO. 31	ANALOG INPUT NO. 41	ANALOG INPUT NO. 49	ANALOG INPUT NO. 55	SYNCHRO REF 2	ANALOG INPUT NO. 65	ANALOG INPUT NO. 75
3	ANALOG INPUT NO. 1	ANALOG INPUT NO. 11	ANALOG INPUT NO. 21	ANALOG INPUT NO. 31	ANALOG INPUT NO. 41	ANALOG INPUT NO. 49	ANALOG INPUT NO. 55	SYNCHRO REF 0A	ANALOG INPUT NO. 65	ANALOG INPUT NO. 75
4	ANALOG INPUT NO. 3	ANALOG INPUT NO. 13	ANALOG INPUT NO. 23	ANALOG INPUT NO. 33	ANALOG INPUT NO. 43	ANALOG INPUT NO. 49	ANALOG INPUT NO. 55	SYNCHRO REF 0B	ANALOG INPUT NO. 67	ANALOG INPUT NO. 77
5	ANALOG INPUT NO. 3	ANALOG INPUT NO. 13	ANALOG INPUT NO. 23	ANALOG INPUT NO. 33	ANALOG INPUT NO. 43	ANALOG INPUT NO. 51	ANALOG INPUT NO. 57	SYNCHRO REF 0C	ANALOG INPUT NO. 67	ANALOG INPUT NO. 77
6	ANALOG INPUT NO. 3	ANALOG INPUT NO. 13	ANALOG INPUT NO. 23	ANALOG INPUT NO. 33	ANALOG INPUT NO. 43	ANALOG INPUT NO. 51	ANALOG INPUT NO. 57	SPARE	ANALOG INPUT NO. 67	ANALOG INPUT NO. 77
7	ANALOG INPUT NO. 5	ANALOG INPUT NO. 15	ANALOG INPUT NO. 25	ANALOG INPUT NO. 35	ANALOG INPUT NO. 45	ANALOG INPUT NO. 51	ANALOG INPUT NO. 57	SPARE	ANALOG INPUT NO. 69	ANALOG INPUT NO. 79
8	ANALOG INPUT NO. 5	ANALOG INPUT NO. 15	ANALOG INPUT NO. 25	ANALOG INPUT NO. 35	ANALOG INPUT NO. 45	ANALOG INPUT NO. 51	ANALOG INPUT NO. 57	SPARE	ANALOG INPUT NO. 69	ANALOG INPUT NO. 79
9	ANALOG INPUT NO. 5	ANALOG INPUT NO. 15	ANALOG INPUT NO. 25	ANALOG INPUT NO. 35	ANALOG INPUT NO. 45	ANALOG INPUT NO. 53	ANALOG INPUT NO. 59	SPARE	ANALOG INPUT NO. 69	ANALOG INPUT NO. 79
10	ANALOG INPUT NO. 7	ANALOG INPUT NO. 17	ANALOG INPUT NO. 27	ANALOG INPUT NO. 37	ANALOG INPUT NO. 45	ANALOG INPUT NO. 53	ANALOG INPUT NO. 59	SPARE	ANALOG INPUT NO. 71	ANALOG INPUT NO. 81
11	ANALOG INPUT NO. 7	ANALOG INPUT NO. 17	ANALOG INPUT NO. 27	ANALOG INPUT NO. 37	ANALOG INPUT NO. 47	ANALOG INPUT NO. 53	ANALOG INPUT NO. 59	SPARE	ANALOG INPUT NO. 71	ANALOG INPUT NO. 81
12	ANALOG INPUT NO. 7	ANALOG INPUT NO. 17	ANALOG INPUT NO. 27	ANALOG INPUT NO. 37	ANALOG INPUT NO. 47	ANALOG INPUT NO. 53	ANALOG INPUT NO. 59	SPARE	ANALOG INPUT NO. 71	ANALOG INPUT NO. 81
13	ANALOG INPUT NO. 9	ANALOG INPUT NO. 19	ANALOG INPUT NO. 29	ANALOG INPUT NO. 39	ANALOG INPUT NO. 47	SPARE	ANALOG INPUT NO. 61	ANALOG INPUT NO. 63	ANALOG INPUT NO. 73	ANALOG INPUT NO. 83
14	ANALOG INPUT NO. 9	ANALOG INPUT NO. 19	ANALOG INPUT NO. 29	ANALOG INPUT NO. 39	ANALOG INPUT NO. 47	ACCELERO-METER EXC. H	ANALOG INPUT NO. 61	ANALOG INPUT NO. 63	ANALOG INPUT NO. 73	ANALOG INPUT NO. 83
15	ANALOG INPUT NO. 9	ANALOG INPUT NO. 19	ANALOG INPUT NO. 29	ANALOG INPUT NO. 39	ANALOG INPUT NO. 47	ACCELERO-METER EXC. H	ANALOG INPUT NO. 61	ANALOG INPUT NO. 63	ANALOG INPUT NO. 73	ANALOG INPUT NO. 83

ATTACHMENT 3-2 (cont'd)
DFDAU ASSIGNMENT

RMP

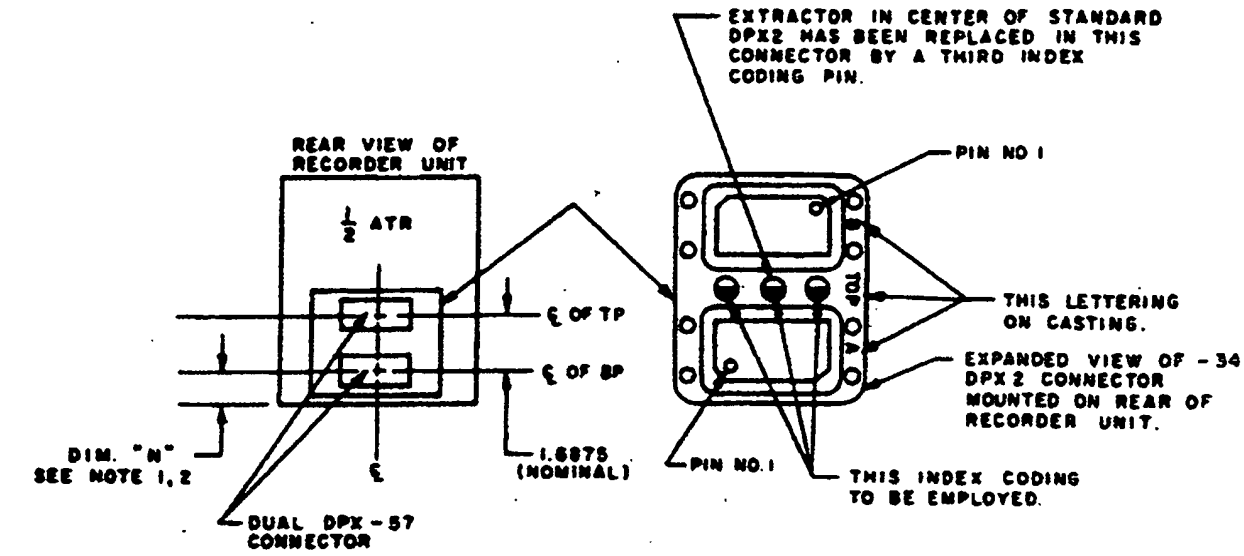
	A	B	C	D	E	F	G	H	J	K
1	ANALOG INPUT NO. 2	ANALOG INPUT NO. 12	ANALOG INPUT NO. 22	ANALOG INPUT NO. 32	ANALOG INPUT NO. 42	ANALOG INPUT NO. 50	ANALOG INPUT NO. 56	RESERVED FILE DATA IN (HI)	ANALOG INPUT NO. 66	ANALOG INPUT NO. 76
2	ANALOG INPUT NO. 2	ANALOG INPUT NO. 12	ANALOG INPUT NO. 22	ANALOG INPUT NO. 32	ANALOG INPUT NO. 42	ANALOG INPUT NO. 50	ANALOG INPUT NO. 56	RESERVED FILE DATA IN (LO)	ANALOG INPUT NO. 66	ANALOG INPUT NO. 76
3	ANALOG INPUT NO. 2	ANALOG INPUT NO. 12	ANALOG INPUT NO. 22	ANALOG INPUT NO. 32	ANALOG INPUT NO. 42	ANALOG INPUT NO. 50	ANALOG INPUT NO. 56	RESERVED FILE DATA OUT (HI)	ANALOG INPUT NO. 66	ANALOG INPUT NO. 76
4	ANALOG INPUT NO. 4	ANALOG INPUT NO. 14	ANALOG INPUT NO. 24	ANALOG INPUT NO. 34	ANALOG INPUT NO. 44	ANALOG INPUT NO. 50	ANALOG INPUT NO. 56	RESERVED FILE DATA OUT (LO)	ANALOG INPUT NO. 68	ANALOG INPUT NO. 78
5	ANALOG INPUT NO. 4	ANALOG INPUT NO. 14	ANALOG INPUT NO. 24	ANALOG INPUT NO. 34	ANALOG INPUT NO. 44	ANALOG INPUT NO. 52	ANALOG INPUT NO. 58	OPTIONAL DATA OUTPUT NO. 2	ANALOG INPUT NO. 68	ANALOG INPUT NO. 78
6	ANALOG INPUT NO. 4	ANALOG INPUT NO. 14	ANALOG INPUT NO. 24	ANALOG INPUT NO. 34	ANALOG INPUT NO. 44	ANALOG INPUT NO. 52	ANALOG INPUT NO. 58	OPTIONAL DATA OUTPUT NO. 2	ANALOG INPUT NO. 68	ANALOG INPUT NO. 78
7	ANALOG INPUT NO. 6	ANALOG INPUT NO. 16	ANALOG INPUT NO. 26	ANALOG INPUT NO. 36	ANALOG INPUT NO. 46	ANALOG INPUT NO. 52	ANALOG INPUT NO. 58	DATA LOADER IMPUT	ANALOG INPUT NO. 70	ANALOG INPUT NO. 80
8	ANALOG INPUT NO. 6	ANALOG INPUT NO. 16	ANALOG INPUT NO. 26	ANALOG INPUT NO. 36	ANALOG INPUT NO. 46	ANALOG INPUT NO. 52	ANALOG INPUT NO. 58	DATA LOADER IMPUT	ANALOG INPUT NO. 70	ANALOG INPUT NO. 80
9	ANALOG INPUT NO. 6	ANALOG INPUT NO. 16	ANALOG INPUT NO. 26	ANALOG INPUT NO. 36	ANALOG INPUT NO. 46	ANALOG INPUT NO. 54	ANALOG INPUT NO. 60	SPARE	ANALOG INPUT NO. 70	ANALOG INPUT NO. 80
10	ANALOG INPUT NO. 8	ANALOG INPUT NO. 18	ANALOG INPUT NO. 28	ANALOG INPUT NO. 38	ANALOG INPUT NO. 46	ANALOG INPUT NO. 54	ANALOG INPUT NO. 60	DATA LOADER IMPUT	ANALOG INPUT NO. 72	ANALOG INPUT NO. 82
11	ANALOG INPUT NO. 8	ANALOG INPUT NO. 18	ANALOG INPUT NO. 28	ANALOG INPUT NO. 38	ANALOG INPUT NO. 48	ANALOG INPUT NO. 54	ANALOG INPUT NO. 60	DATA LOADER ENABLE DISCRETE	ANALOG INPUT NO. 72	ANALOG INPUT NO. 82
12	ANALOG INPUT NO. 8	ANALOG INPUT NO. 18	ANALOG INPUT NO. 28	ANALOG INPUT NO. 38	ANALOG INPUT NO. 48	ANALOG INPUT NO. 54	ANALOG INPUT NO. 60	SPARE	ANALOG INPUT NO. 72	ANALOG INPUT NO. 82
13	ANALOG INPUT NO. 10	ANALOG INPUT NO. 20	ANALOG INPUT NO. 30	ANALOG INPUT NO. 40	ANALOG INPUT NO. 48	POTENTIO-METER SENSING	ANALOG INPUT NO. 62	ANALOG INPUT NO. 64	ANALOG INPUT NO. 74	ANALOG INPUT NO. 84
14	ANALOG INPUT NO. 10	ANALOG INPUT NO. 20	ANALOG INPUT NO. 30	ANALOG INPUT NO. 40	ANALOG INPUT NO. 48	ACCELERO-METER EXC. H	ANALOG INPUT NO. 62	ANALOG INPUT NO. 64	ANALOG INPUT NO. 74	ANALOG INPUT NO. 84
15	ANALOG INPUT NO. 10	ANALOG INPUT NO. 20	ANALOG INPUT NO. 30	ANALOG INPUT NO. 40	PROBE EXC. RETURN	ACCELERO-METER EXC. C	ANALOG INPUT NO. 62	ANALOG INPUT NO. 64	ANALOG INPUT NO. 74	ANALOG INPUT NO. 84

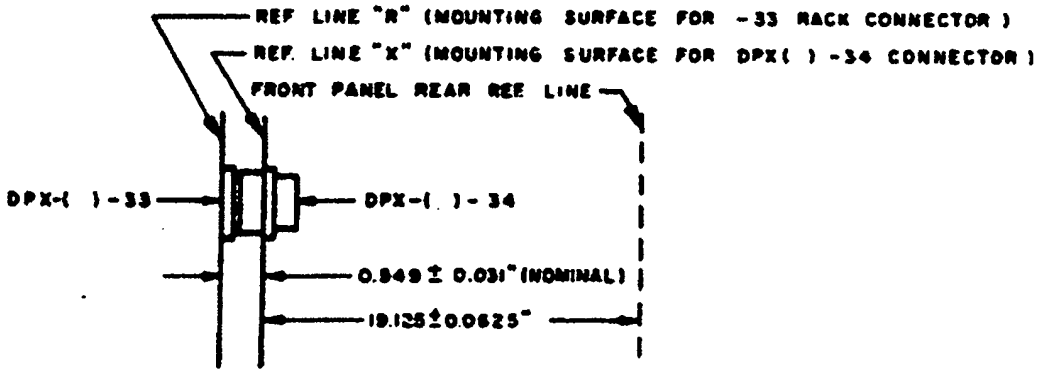
¢-9

¢-4

THIS PAGE IS INTENTIONALLY BLANK

ATTACHMENT 3-3
DFDR FORM FACTOR CONNECTOR LOCATIONS (REAR VIEW)

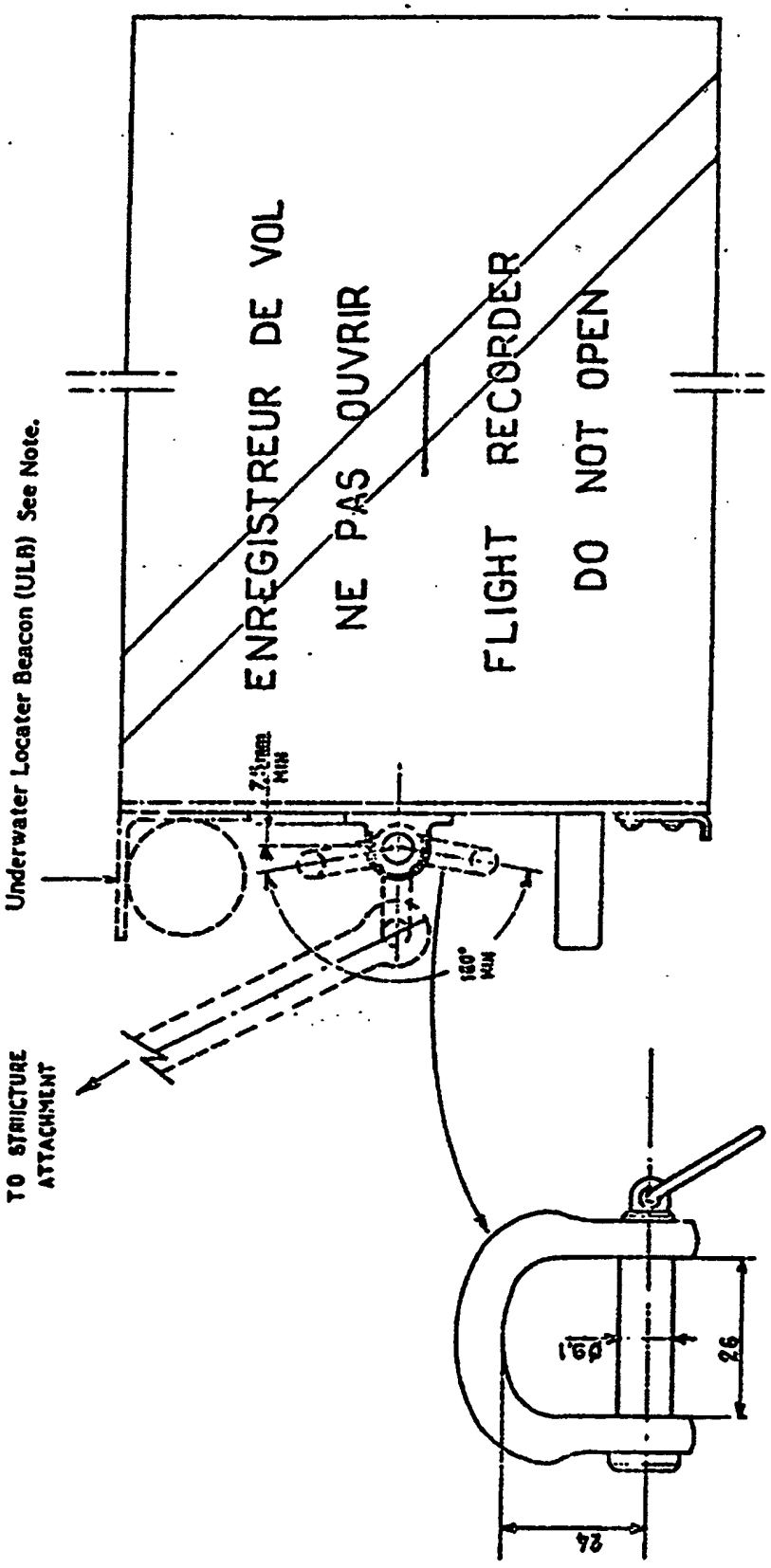




NOTES: DETAILS OF CONNECTOR LOCATIONS. (SEE DATA SHEET 5A OF ARINC SPEC. 404)

1. DIMENSION "N" OF (DATA SHEET NO.4 OF ARINC SPEC. 404) APPLIES TO LOCATION OF A SINGLE DPX CONNECTOR OR THE BOTTOM DPX CONNECTOR AS SHOWN ABOVE.
2. DIMENSION "Q" (DATA SHEET NO.8 OF ARINC SPEC. 404.) APPLIES TO THE VERTICAL LOCATION OF REAR HOLD-DOWNS USED ON CASES EMPLOYING SINGLE OR DUAL DPX CONNECTORS.

ATTACHMENT 3-3 (cont'd)
DFDR STRUCTURE PROVISION



NOTE: This secondary structure attachment may be required by the French DGAC. The DGAC does not require a ULB. The ULB is shown on the drawing for use only as a positional reference. When the secondary attachment is specified by a user (under jurisdiction of the French DGAC), the ULB should not be specified (on the flight recorder) due to physical interference problems that may result. (See Appendix 3).

ATTACHMENT 3-4
PIN ASSIGNMENT DFDR
CONNECTOR DPX2MA - 57POOP - 34 - 001

1	H		115 VAC Input	30	USF	6P	RESERVED-
2	C			31	USF	7P	
3	FS		(2)	32	USF	8P	UNSPECIFIED FUNCTION
4	FS		Future Spare	33	USF	9P	(1)
5	FS			34	USF	10P	WIRES FOR PLAY BACK
6			Case Ground	35	USF	11P	
7	H		Digital (3)	36	USF	12P	OR GROUND CHECK-
8	C		Input	37	USF	13P	
9			HI ├ Play Back (Serial Data Output) (3)	38	USF	14P	OUT USE
10			LO	39	USF	15P	
11	FS			40	USF	16P	
12	FS			41	USF	17P	
13	FS			42	USF	18P	
14	FS		Future Spares (2)	43	USF	19P	
15	FS			44	USF	20P	
16	FS			45	USF	21P	
17	FS			46	FS		
18	FS			47	FS		
19	USF	3 P	RESERVED - (1)	48	FS		
20	USF	4 P	Play Back	49	FS		
21	H		SYSTEM STATUS OUTPUT	50	FS		
22	H		MAINTENANCE FLAG OUTPUT	51	FS		FUTURE SPARES (2)
23	H		+27.5 VDC Input	52	FS		
24	FS			53	FS		
25	FS			54	FS		
26	FS		Future Spares (1)	55	FS		
27	FS			56	FS		
28	FS			57	FS		
29	USF	5 P	RESERVED Play Back (1)				

NOTES:

(1) An optional aircraft installation may provide wires from each USF-( )P (UNSPECIFIED FUNCTION) pin to a connector (type not defined) Located at some point in the aircraft which provides convenient access for the maintenance people. This interwiring is to be used for maintenance purposes only and will not be terminated during normal operation.

Equipment designers should take note of and guard against faults which might arise from inadvertent connection of other than the correct test equipment to these circuits.

(2) FS - Future Spares may be used in the future by INDUSTRY decision for additions to the Standard Installation and should not be used by manufacturers without prior Industry coordination. See Section 5.4 of ARINC 414 for a description of the different categories of interwiring.

(3) Indicates wires noted should be twisted and shielded with an insulating jacket over the shield.

ALTERNATIVE DFDR CONNECTOR PIN ASSIGNMENTS

The alternative DFDR described in the note under Section 2.1.2 will employ, instead of the connector specified above, a type KPTM6F-14-19S82, or equivalent, connector (meeting with a pendant cable and connector in the aircraft) with the following pin connections:

Pin:

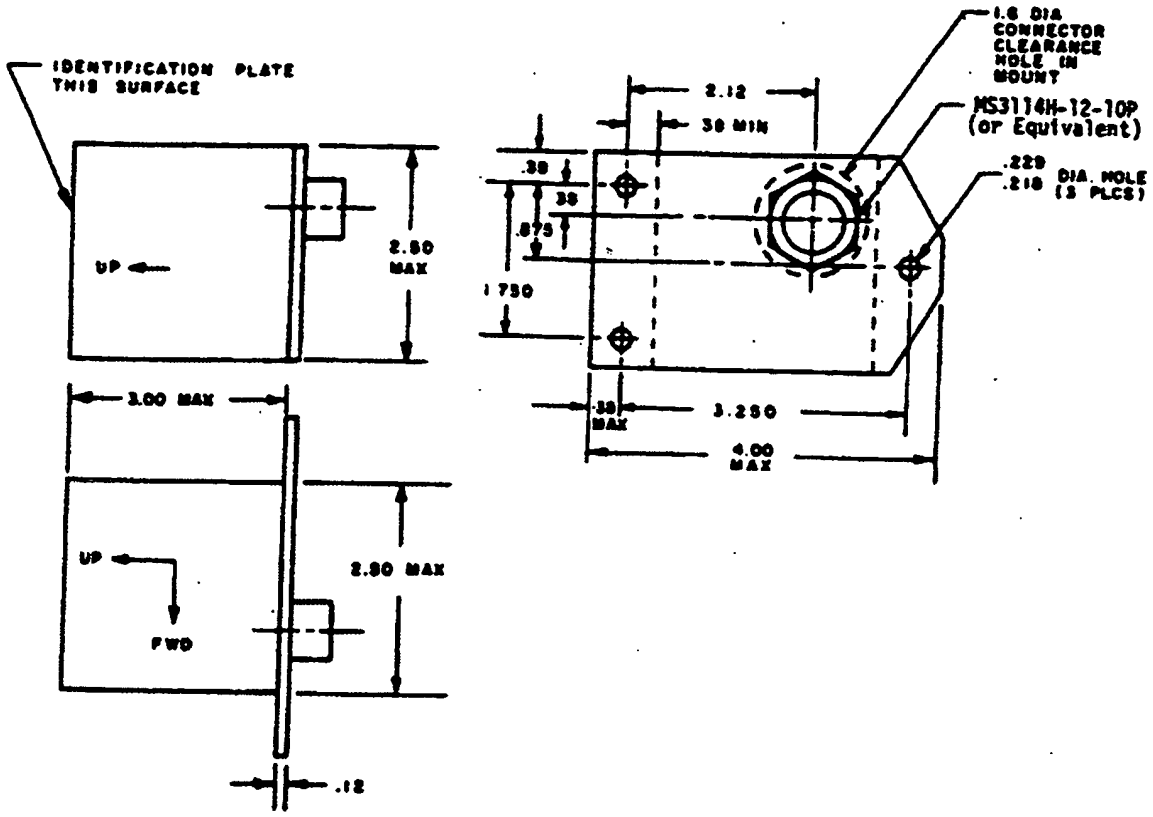
A		115 VAC Input
B		115 VAC Ground
D		
E		
G	Case Ground	
H	A	├ Digital Data Input *
J	B	
K	H	├ Play Back (Serial Data Output) *
L	C	
R	USF 3P	
S	USF 4P	
T	System	├ Failure Warning
U	Maint. Flag	
V	Common	
P	+27.5 VDC Input for Failure Warning	

NOTE:

All pins in the KPTM6F-14-19S82 connector not assigned function above should be wired to a conveniently located test connector installed in the aircraft for maintenance uses. Pins not shown are C, F, M and N.

* Twisted Shielded Pair

ATTACHMENT 3-5
ACCELEROMETER FORM FACTOR



TOLERANCE UNLESS OTHERWISE SPECIFIED:

XX ±.03

XXX ±.010

ATTACHMENT 3-6
ACCELEROMETER PIN ASSIGNMENT

CONNECTOR NUMBER: See Attachment 3-3

A	+28 VDC		
B	Power Ground		
C	H	⎫	VERTICAL OUTPUT *
D	C	⎭	
E	H	⎫	LATERAL OUTPUT *
F	C	⎭	
G	H	⎫	LONGITUDINAL OUTPUT *
H	C	⎭	
J	RESERVED		Supplier Specified
K	RESERVED		Test Signals

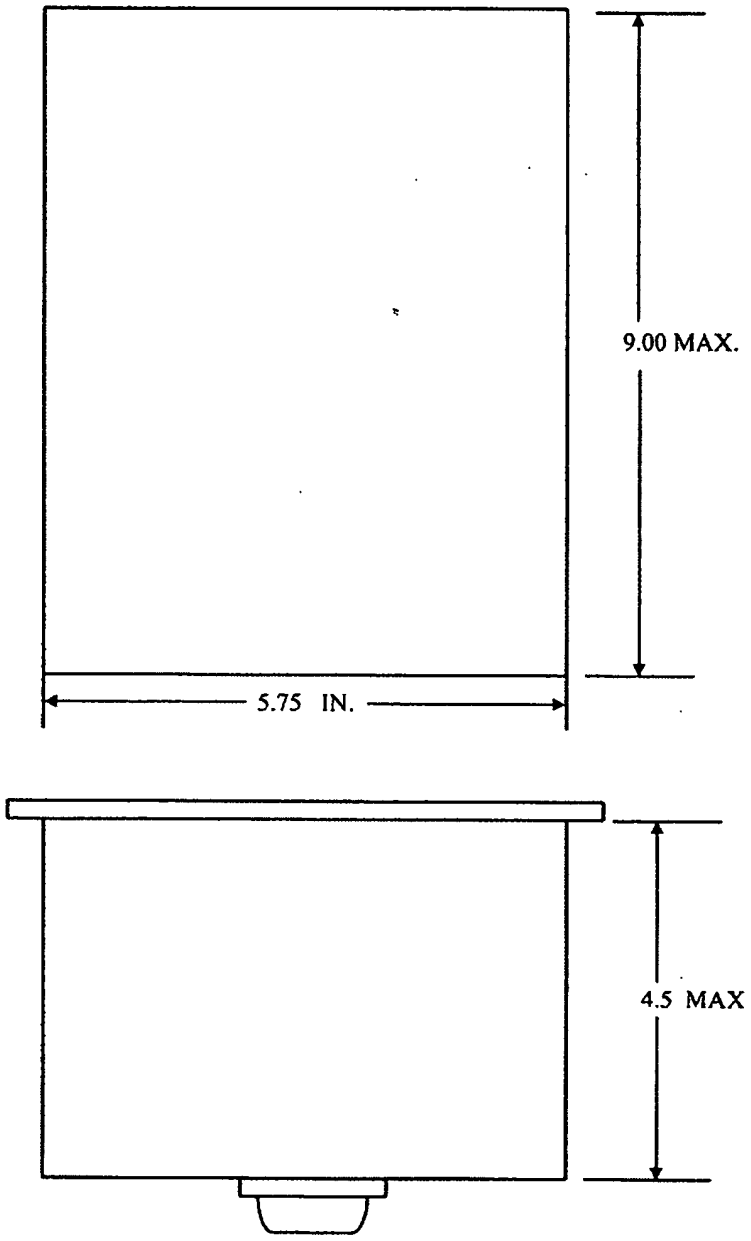
¢-2

NOTES:

(1) Output Signals "H" and "C" correspond to the "+" and "-" polarities respectively, however, the "C" lead should not be grounded in the aircraft, FDAU or utilization equipment because of potential ground loops. The "C" circuit should be connected inside the accelerometer to the power ground (Pin B) (which should be connected to aircraft structure only through the FDA as shown in Attachment 2-1) to minimize common mode noise voltages

(2) *Indicates wires noted should be twisted and shielded with an insulating jacket over the shield.

ATTACHMENT 3-7
FDEP PHYSICAL CHARACTERISTICS



MS3122E20-41P or equivalent

ATTACHMENT 3-8
CONTROL PANEL AND DATA ENTRY PANEL PIN ASSIGNMENT

A				X	H	Power (See Section 2.5.2)
B				Y	H	Control
C	A	Data In	(1)	Z	H	
D	B			a		
E	A	Data Out	(1)	b	H	DFDAU BITE
F	B			c		
G	A	DFDR Data In	(1)	d		
H	B			e		
J				f	H	5V Panel
K	H	Status In		g	C	Lights
L	H	Indicator Power		h		
M	L			i		
N	C	(Dimming Ground)		j	H	Event Marker
P				k		
R	H	115 VAC		m	H	QAR Control
S	C			n	H	(Contract Closure)
T				p		
U	H	QAR BITE		q		
V	H	QAR Tape Low		r		
W				s	C	Digital Ground
				t	C	Case Ground

¢-6

NOTES:

(1) Indicates wires noted should be twisted and shielded with an insulating jacket over the shield as indicated in Attachment 8.

(2) A Ground Test Switch may be part of the FDEP (See Section 2.5).

(3) The cockpit disconnect plug and receptacle wired between the DFDAU and the Control Panel/FDEP will be specified by the user.

ATTACHMENT 4
DATA FRAME DESCRIPTION

1. One frame of data contains four subframes each with 64 words, each with 12 bits.

2. The frame is repeated every four seconds with a bit rate of 768 Hz.

3. There is one subframe per second. The timing tolerance is 0.1 % as shown in Attachment 9-6.

4. The subframes are numbered one to four from the beginning of each subframe.

6. The bits are numbered from one to twelve from the beginning of each word.

7. Bit number one is the least significant bit (LSB) and transmitted first.

8. Bit number twelve is the most significant bit (MSB) and transmitted last.

9. Word number one of each subframe is the synch word.
The synch words are specified by this Characteristic.

Subframe One Synch word	-	MSB 001 001 000 111 LSB; Octal 1107
Subframe Two Synch word	-	MSB 010 110 111 000 LSB; Octal 2670
Subframe Three Synch word	-	MSB 101 001 000 111 LSB; Octal 5107
Subframe Four Synch word	-	MSB 110 110 111 000 LSB; Octal 6670

10. Words two through 64 contain data as assigned by the ROM described in Section 5.1.2.

11. Words may be identified as, for example
ALL/33-word 33 of all four subframes
1/3-Subframe one, word 3
1,3/16-Subframe one, and three, word 16
All/18,50-Words 18 and 50 of all subframes.

12. Bits may be identified as, for example
All/6/1-Bit 1 (LSB) of word six in all subframes.
1/14/4-6-Bits four to six of subframe one, word 14.

ATTACHMENT 5-1
INPUT CONNECTOR PIN ASSIGNMENT STANDARDS

A. Analog inputs - 60 total

Type of Input	Connector Pin a	b	c	d	Ref. Section	Comments
Synchro	X	Z	Y	OPEN	4.2.1	Sep. reference input
AC Voltage Ratio 1	H	C	R	OPEN	4.2.2	
AC Voltage Ratio 2	H	C	R	OPEN	4.2.3	
DC Voltage	H	C	OPEN	OPEN	4.2.4	
DC Voltage Ratio	H	C	R	OPEN	4.2.5	
Potentiometer	H	C	OPEN	OPEN	4.2.6	DFDAU excited (See 4.6.1)
Resistance Probe	H	C	OPEN	EXC.	4.2.7	DFDAU excited (See 4.6.3)

¢-1

NOTE: All analog inputs should accept any analog signal type, except that only analog inputs 45-60 may accept resistance probe signals.

B. Discrete inputs-99 total

Each discrete is assigned one pin.

ATTACHMENT 5-2
SUMMARY OF ANALOG INPUT ASSIGNMENTS

NO	RECOMMENDED DATA	SAMPLES/SEC FAA	CONNECTOR PIN INSERT	A	B	C	D
1	Vertical Acceleration	4	LMP	1A	2A	3A	
2	Pitch Trim	1/2	RMP	1A	2A	3A	
3	Lateral Acceleration	4	LMP	4A	5A	6A	
4	Control Column Position	1	RMP	4A	5A	6A	
5	Wheel Position	1	LMP	7A	8A	9A	
6	Pedal Position	2	RMP	7A	8A	9A	
7	Pitch Control Position 2		LMP	10A	11A	12A	
8	Pitch Control Position 3		RMP	10A	11A	12A	
9	Pitch Control Position 4		LMP	13A	14A	15A	
10	Roll Control Position 2		RMP	13A	14A	15A	
11	Roll Control Position 3		LMP	1B	2B	3B	
12	Roll Control Position 4		RMP	1B	2B	3B	
13	Longitudinal Acceleration		LMP	4B	5B	6B	
14	Flap Handle Position		RMP	4B	5B	6B	
15	Spoiler Handle Position		LMP	7B	8B	9B	
16	Trailing Edge Flap 1	1/2	RMP	7B	8B	9B	
17	Trailing Edge Flap 2		LMP	10B	11B	12B	
18	Trailing Edge Flap 3		RMP	10B	11B	12B	
19	Trailing Edge Flap 4		LMP	13B	14B	15B	
20	Yaw Control Position 2		RMP	13B	14B	15B	
21	Yaw Control Position 3		LMP	1C	2C	3C	
22	Angle of Airflow		RMP	1C	2C	3C	
23	EPR-1	1/4 (2)	LMP	4C	5C	6C	
24	EPR-2	1/4	RMP	4C	5C	6C	
25	EPR-3	1/4	LMP	7C	8C	9C	
26	EPR-4	1/4 (2)	RMP	7C	8C	9C	
27	N1-1	1/4	LMP	10C	11C	12C	
28	N1-2	1/4	RMP	10C	11C	12C	
29	N1-3	1/4	LMP	13C	14C	15C	
30	N1-4	1/4	RMP	13C	14C	15C	
31	Fuel Flow 1		LMP	1D	2D	3D	
32	Fuel Flow 2		RMP	1D	2D	3D	
33	Fuel Flow 3		LMP	4D	5D	6D	
34	Fuel Flow 4		RMP	4D	5D	6D	
35	EGT 1		LMP	7D	8D	9D	
36	EGT 2		RMP	7D	8D	9D	
37	EGT 3		LMP	10D	11D	12D	
38	EGT 4		RMP	10D	11D	12D	
39	VSV 1		LMP	13D	14D	15D	
40	VSV 2		RMP	13D	14D	15D	
41	VSV 3		LMP	1E	2E	3E	
42	VSV4		RMP	1E	2E	3E	
43	Turbine Press 1		LMP	4E	5E	6E	
44	Turbine Press 2		RMP	4E	5E	6E	
45 (3)	Turbine Press 3		LMP	7E	8E	9E	10E
46	Turbine Press 4		RMP	7E	8E	9E	10E
47	LPC Discharge Press 1		LMP	11E	12E	13E	14E
48	LPC Discharge Press 2		RMP	11E	12E	13E	14E
49	LPC Discharge Press 3		LMP	1F	2F	13F	4F
50	LPC Discharge Press 4		RMP	1F	2F	3F	4F
51			LMP	5F	6F	7F	8F
52	Outside Air Temperature	1/4	RMP	5F	6F	7F	8F
53	LPC Discharge Temp. 1		LMP	9F	10F	11F	12F
54	LPC Discharge Temp. 2		RMP	9F	10F	11F	12F
55	LPC Discharge Temp. 3		LMP	1G	2G	3G	4G
56	LPC Discharge Temp. 4		RMP	1G	2G	3G	4G
57	HPC Discharge Temp. 1		LMP	5G	6G	7G	8G
58	HPC Discharge Temp. 2		RMP	5G	6G	7G	8G
59	HPC Discharge Temp. 3		LMP	9G	10G	11G	12G
60	HPC Discharge Temp. 4		RMP	9G	10G	11G	12G

ATTACHMENT 5-2 (cont'd)
SUMMARY OF ANALOG INPUT ASSIGNMENTS

(1) These parameter assignments are recommended in an attempt to achieve some standards for different installations.

(2) If used as a primary thrust indication.

(3) Only inputs no. 45-60 will accept resistance probe signals.

(4) The pin assignment lot of Attachment 2-2 shows pin allocations for analog inputs 61-84. These inputs are optional and not covered by Section 4 and Attachment 7.

ATTACHMENT 5-3 (cont'd)
SUMMARY OF DISCRETE INPUT ASSIGNMENTS

NO	RECOMMENDED PARAMETERS	SAMPLES/SEC FAA	CONNECTOR PIN INSERT PIN
1.	Shunt Discretes - 20 total per Section 4.4.2		
1	FDEP Event Marker		LTP15G
2			RTP1A
3	VHF-1 Key	1	LTP1A
4	VHF-2 Key	1	RTP1B
5	VHF-3 Key	1	LTP1B
6			RTP1C
7	HF-1 Key	1	LTP1C
8	HF-2 Key	1	RTP1D
9			LTP1D
10			RTP1E
11	Reverser 1-1	1 every 4 mainframes	LTP1E
12	Reverser 1-2	1 every 4 mainframes	RTP1F
13	Reverser 1-3	1 every 4 mainframes	LTP1F
14	Reverser 1-4	1 every 4 mainframes	RTP1G
15			LTP1G
16			RTP1H
17			LTP1H
18			RTP1J
19			LTP1J
20			RTP1K
2.	Series Discretes-50 total per Section 4.4.1		
21	LE Flap 1	1	LTP1K
22	LE Flap 2		RTP3A
23	LE Flap 3		LTP3A
24	LE Flap 4		RTP3B
25			LTP3B
26			RTP3C
27			LTP3C
28			RTP3D
29	Reverser 2-1	1 every 4 mainframes	LTP3D
30	Reverser 2-2	1 every 4 mainframes	RTP3E
31	Reverser 2-3	1 every 4 mainframes	LTP3E
32	Reverser 2-4	1 every 4 mainframes	RTP3F
33			LTP3F
34			RTP3G
35			LTP3G
36			RTP3H
37	Strut Switch		LTP3H
38			RTP3J
39			LTP3J
40			RTP3K
41			LTP3K
42			RTP5A
43			LTP5A
44			RTP5B
45			LTP5B
46			RTP5C
47			LTP5C
48			RTP5D
49			LTP5D
50			RTP5E
51			LTP5E
52			RTP5F
53			LTP5F
54			RTP5G
55			LTP5G
56			RTP5H
57			LTP5H
58			RTP5J
59			LTP5J
60			RTP5K

ATTACHMENT 5-3 (cont'd)
SUMMARY OF DISCRETE INPUT ASSIGNMENTS

NO	RECOMMENDED PARAMETERS	SAMPLES/SEC FAA	CONNECTOR PIN INSERT PIN
61			LTP5K
62			RTP7A
63			LTP7A
64			RTP7B
65			LTP7B
66			RTP7C
67			LTP7C
68			RTP7D
69			LTP7D
70			RTP7E
3.	AC Discretes-Eight total per Section 4.4.3		
71			LTP7E
72			RTP7F
73			LTP7F
74			RTP7G
75			LTP7G
76			RTP7H
77			LTP7H
78			RTP7J
4.	Marker beacon Discretes-Three total per Section 4.4.5		
79	Inner Marker		LTP7J
80	Outer Marker		RTP7K
81	Airways Marker		LTP7K
5.	Ident Discretes-18 total per Section 4.4.6		
82	A/C Type 1		RTP9A
83	A/C Type 2		RTP9B
84	A/C Type 4		RTP9C
¢-2 85	A/C Type 8		RTP9D
86	A/C Type 16		RTP9E
87	A/C Type 32		RTP9F
88	Fleet Ident 1		RTP9G
89	Fleet Ident 2		RTP9H
90	Fleet Ident 4		RTP9J
91	Fleet Ident 8		RTP9K
92	A/C Number 1		RTP11A
93	A/C Number 2		RTP11B
94	A/C Number 4		RTP11C
95	A/C Number 8		RTP11D
96	A/C Number 16		RTP11E
97	A/C Number 32		RTP11F
98	A/C Number 64		RTP11G
¢-10 99	A/C Number 128		RTP11H
100	A/C Type 64		RTP11J

(1) These parameter assignments are recommended in an attempt to achieve some standards for different installations.

ATTACHMENT 5-4
IDENT DISCRETE ASSIGNMENTS

100	87	86	85	84	83	82	Aircraft Type	
						X	Boeing 767-200 (P&W Engine)	
					X		Boeing 767-200 (GE Engine)	
					X	X	Boeing 757-200 (RR Engine)	
				X			Boeing 757-200 (P&W Engine)	
				X		X	Airbus A-310-200 (GE CF6-80 Engines)	
				X	X		Airbus A-310-200 (P&W JT9D-7R4 Engines)	
				X	X	X	Airbus A-310-200 (RR RB-211 Engines)	¢-4
			X				Airbus A-300-600 (GE CF6-80 Engines)	
			X			X	Airbus A-300-600 (P&W JT9D-7R4 Engines)	
			X		X		Airbus A-310-600 (RR RB-211 Engines)	
			X		X	X	Boeing 737-200	
			X	X			Boeing 737-300	
			X	X		X	Airbus A-310-300 (GE CF-6-80 Engines)	
			X	X	X		Airbus A-310-300 (P&W JT9D-7RA Engines)	¢-5
			X	X	X	X	Airbus A-310-300 (RR RB-211 Engines)	
		X					Fokker F-28 MK0100	
		X				X	Boeing 767-300 (P&W Engines)	
		X			X		Boeing 767-300 (GE Engines)	
		X			X	X	Airbus A-320-200 (P&W Engines)	
		X		X			Airbus A-320-200 (GE Engines)	
		X		X		X	Boeing 747-300 (P&W JT9D Engines)	
		X		X	X		Boeing 747-300 (GE CF6-45/50 Engines)	
		X		X	X	X	Boeing 747-300 (P&W PW-4000 Engines)	
		X	X				Boeing 747-300 (GE CF6-80C2 Engines)	
		X	X			X	Boeing 747-400 (P&W PW-4000 Engines)	
		X	X		X		Boeing 747-400 (GE CF6-80C2 Engines)	
		X	X		X	X	Boeing 747-300 (RR RB-211 Engines)	
		X	X	X			Boeing 747-400 (RR RB-211 Engines)	
		X	X	X		X	Airbus A-310-200 (P&W PW-4000 Engines)	
		X	X	X	X		Airbus A-310-300 (P&W PW-4000 Engines)	
		X	X	X	X	X	Airbus A-300-600 (P&W PW-4000 Engines)	
	X						Airbus A-300-600R (GE CF6-80 Engines)	
	X					X	Airbus A-300-600R (P&W JT9D-7R4 Engines)	
	X				X		Airbus A-300-600R (P&W PW-4000 Engines)	
	X				X	X	Airbus A-300-600R (RR RB-211 Engines)	
	X			X			Boeing 737-400	
	X			X		X	Lockheed Tristar-500 K MK2 (RR RB-211 Engines)	
	X			X	X		Boeing 767-200 (RR Engines)	
	X			X	X	X	Boeing 767-300 (RR Engines)	
	X		X				Boeing 767-200 (GE-80C2 Engine w/FADEC)	
	X		X			X	Boeing 767-300 (GE-80C2 Engine w/FADEC)	
	X		X		X		Boeing 737-500	
	X		X		X	X	Douglas MD-11 (PW-4000 Engine)	
	X		X	X			Douglas MD-11 (GE-CF6-80C2 Engine)	¢-9
	X		X	X		X	Douglas MD-11 (RR RB-211 Engines)	
	X		X	X	X		Douglas MD-81	
	X		X	X	X	X	Douglas MD-82	
	X	X					Douglas MD-83	
	X	X				X	Douglas MD-87	
	X	X			X		Douglas MD-88	
	X	X			X	X	Airbus A-330-300 (RR Engines)	
	X	X		X			Airbus A-330-300 (P&W Engines)	
	X	X		X		X	Airbus A-330-300 (CFMI Engines)	
	X	X		X	X		Airbus A-340-200 (CFMI Engines)	
	X	X		X	X	X	Airbus A-340-300 (CFMI Engines)	
	X	X	X				Douglas MD-90-30	
	X	X	X			X	Airbus A-310-300 (GE CF6-80C2 Engine w/FADEC)	
	X	X	X		X		Airbus A-300-600R (GE CF6-80C2 Engine w/FADEC)	
	X	X	X		X	X	Fokker F28 MK0070	
	X	X	X	X			Fokker F28 MK0130	
	X	X	X	X		X	Ilyushin IL-96T (P&W 2337 Engines)	
	X	X	X	X	X		Ilyushin IL-96M (P&W 2337 Engine)	
	X	X	X	X	X	X	Boeing 737-600	
X							Boeing 737-700	
X						X	Boeing 737-800	

X denotes connection to ident common (RTP11K)

ATTACHMENT 6
SUMMARY OF DITS INPUT ASSIGNMENTS

DITS PORT NO.	RECOMMENDED SOURCE (1)	SDI (binary)	CONNECTOR PINS		
			Insert	A	B
1	Engine #1	01	LTP	13A	13B
2	Engine #2	10	RTP	13A	13B
3	Engine #3	11	LTP	13C	13D
4	Engine #4	00	RTP	13C	13D
5	Air Data System	00	LTP	13E	13F
6		00	RTP	13E	13F
7	GMT Clock	00	LTP	13G	13H
8	ILS	00	RTP	13G	13H
9	Radio Altimeter	00	LTP	13J	13K
10		00	RTP	13J	13K
11		00	LTP	14A	14B
12		00	RTP	14A	14B
13 (2)		00	LTP	14C	14D
14 (2)		00	RTP	14C	14D
15 (2)	Attitude/Heading System	00	LTP	14E	14F
16 (2)		00	RTP	14E	14F
17 (3)		00	LTP	14G	14H
18 (3)		00	RTP	14G	14H
19 (3)		00	LTP	14J	14K
20 (3)		00	RTP	14J	14K
21 (3)		00	LTP	15A	15B
22 (3)		00	RTP	15A	15B
23 (3)		00	LTP	15C	15D
24 (3)		00	RTP	15C	15D

(1) These parameter assignments are recommended in an attempt to achieve some standards for different installations.

(2) Ports No. 13, 14, 15 and 16 may receive data at both the high and low speed rate of ARINC 429 as controlled by the customer ROM.

(3) The incorporation of these ports is the option of the user.

ATTACHMENT 7
GUIDANCE FOR INPUT ISOLATION

Parameter Type	Minimum Isolation Resistance	Maximum I Back
DC Voltage	150K	30 micro amp
DC Ratio	150K	100 micro amp
AC Ratio #1	150K	100 micro amp
AC Ratio #2	150K	100 micro amp
Digital	---- See ARINC 429 ----	
Pots (WIPER)	150K	100 micro amp
Temp Bulb	N/A	N/A
(3 wire)		
Discretes: SERIES	150K	30 micro amp
SHUNT	20K	500 micro amp
AC SENSITIVE	20K	500 micro amp
Marker Beacon	20K	500 micro amp
Synchro (Signals and reference)	150K	100 micro amp

NOTES:

1. The isolation requirements set forth in this Attachment represent the minimum acceptable values and equipment manufacturers are encouraged to provide the highest level of isolation which is economically feasible. It is particularly important that the isolation circuitry preclude degradation of accuracy in the equipment being monitored. No guidance is given for optional types if analog signals.

2. Cross Channel Isolation must be at least equivalent to the values set forth above for normal operation. The designer should give due consideration to the programmable parameters on adjacent connector pins.

3. Failure is described as any reasonably probably failure of internal DFDAU cirucitry including failures in the isolation circuitry.

4. Impedance shown is required in line to line as well as line to ground, for all signals except pots and temp bulbs.

5. I Back is described as the maximum current which can be fed back into the signal line from the DFDAU for both normal and failed conditions.

ATTACHMENT 8
SIGNAL LINE CHARACTERISTICS

See ARINC 429 Attachment 4

ATTACHMENT 9-1
GENERAL WORD FORMATS AND ENCODING EXAMPLES

1. GENERAL WORD FORMATS

32	31 30 29	28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11	10 9	8 7 6 5 4 3 2 1
P (5)	SSM (4)	DATA — PAD (3) — DISCRETES (2)	SDI (1)	LABEL
		MSB LSB		

GENERALIZED BCD WORD FORMAT

P	SSM	BCD MSC	BCD CH #2	BCD CH #3	BCD CH #4	BCD CH #5	SDI	LABEL
		4 2 1	8 4 2 1	8 4 2 1	8 4 2 1	8 4 2 1		
0	0 0	0 1 0	0 1 0 1	0 1 1 1	1 0 0 0	0 1 1 0	0 0	1 0 0 0 0 0 0 1
Example		2	5	7	8	6		DME DISTANCE

BCD WORD FORMAT EXAMPLE (NO DISCRETES)

32	31 30 29	28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11	10 9	8 7 6 5 4 3 2 1
P (5)	SSM (4)	DATA — PAD (3) — DISCRETES (2) LSB	SDI (1)	LABEL
		MSB		

GENERALIZED BNR WORD FORMAT

P	SSM	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{128}$	etc	PAD	SDI	LABEL
0	1 1 0	0	0	1	0	0	0	0	0 0 0 0 0 0 0 0	0 0 0	0 0	0 1 1 0 1 1 1 1
Example		512 Knots (i.e. 1/8 x 4096 where 4096 is entry in range column of Table 2 in Attachment 2.										N-S VELOCITY

BNR WORD FORMAT EXAMPLE (NO DISCRETES)

P	SSM	"STX"	WORD COUNT	WORD COUNT	LABEL
32	31(00) 30	29 23	22 TENS (0) 16	15 UNITS(1) 9	8 1

ALPHA/NUMERIC (ISO ALPHABET NO. 5) DATA - INITIAL WORD FORMAT

P	SSM	DATA CH #3	DATA CH #2	DATA CH #1	LABEL
32	31(10) 30	29 P 23	22 L 16	15 A 9	8 1

ALPHA/NUMERIC (ISO ALPHABET NO. 5) DATA - INTERMEDIATE WORD FORMAT

P	SSM	DATA CH #3	DATA CH #2	DATA CH #1	LABEL
32	31(11) 30	29 (BNR ZEROS) 23	22 A 16	15 H 9	8 1

ALPHA NUMERIC (ISO ALPHABET NO. 5) DATA - FINAL WORD FORMAT

(Taken together, above three word format examples show encoding of the word ALPHA)

NOTE: SUBJECT TO CHANGE BY SUPPLEMENT TO ARINC 429

ATTACHMENT 9-1 (cont'd)
GENERAL WORD FORMATS AND ENCODING EXAMPLES

NOTES

(1) Source/Destination identifier (SDI) Field

The purpose of the SDI fields is explained in Section 2.1.4 of ARINC 429, as are also the limitations on its use. When the SDI function is not required, this field may be occupied by binary zero or valid data pad bits.

(2) Discretes

As discussed in Section 2.3.1.2 of ARINC 429, unused bits in a word may be assigned to discrete functions, one bit per variable. Bit #11 of the word should be the first to be so assigned, followed by bit #12 and so on in ascending numerical order until the data field is reached. In the absence of discretes, unused bit positions should be occupied by binary zero or valid data pad bits.

(3) Pad

All bit positions not used for data or discretes should be filled with binary zero or valid data pad bits. Section 2.1.2 of ARINC 429 refers.

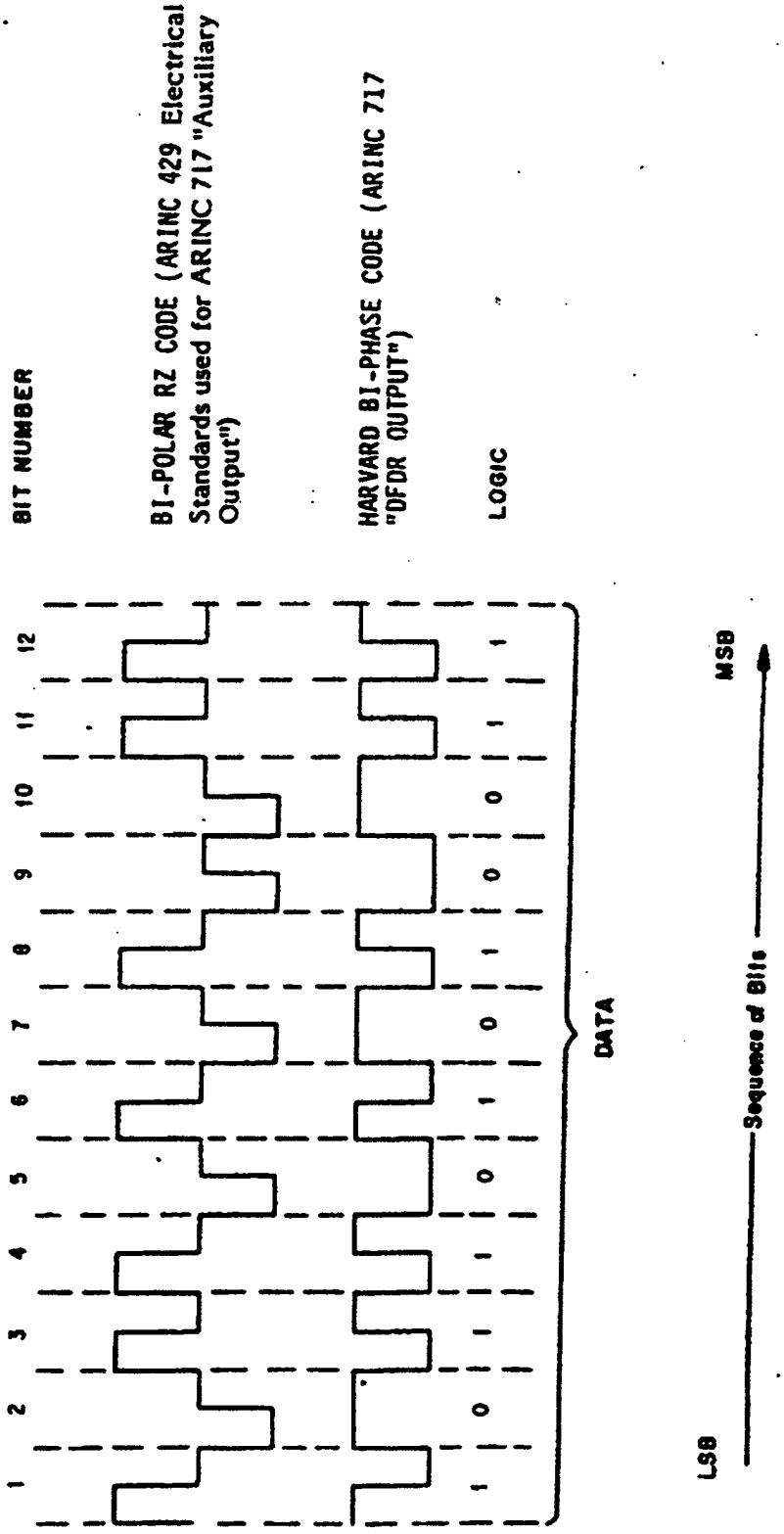
(4) Sign/Status Matrix (SSM)

Section 2.1.5 of ARINC 429 describes the functions of the sign/status matrix and the ways in which the bits constituting it are encoded.

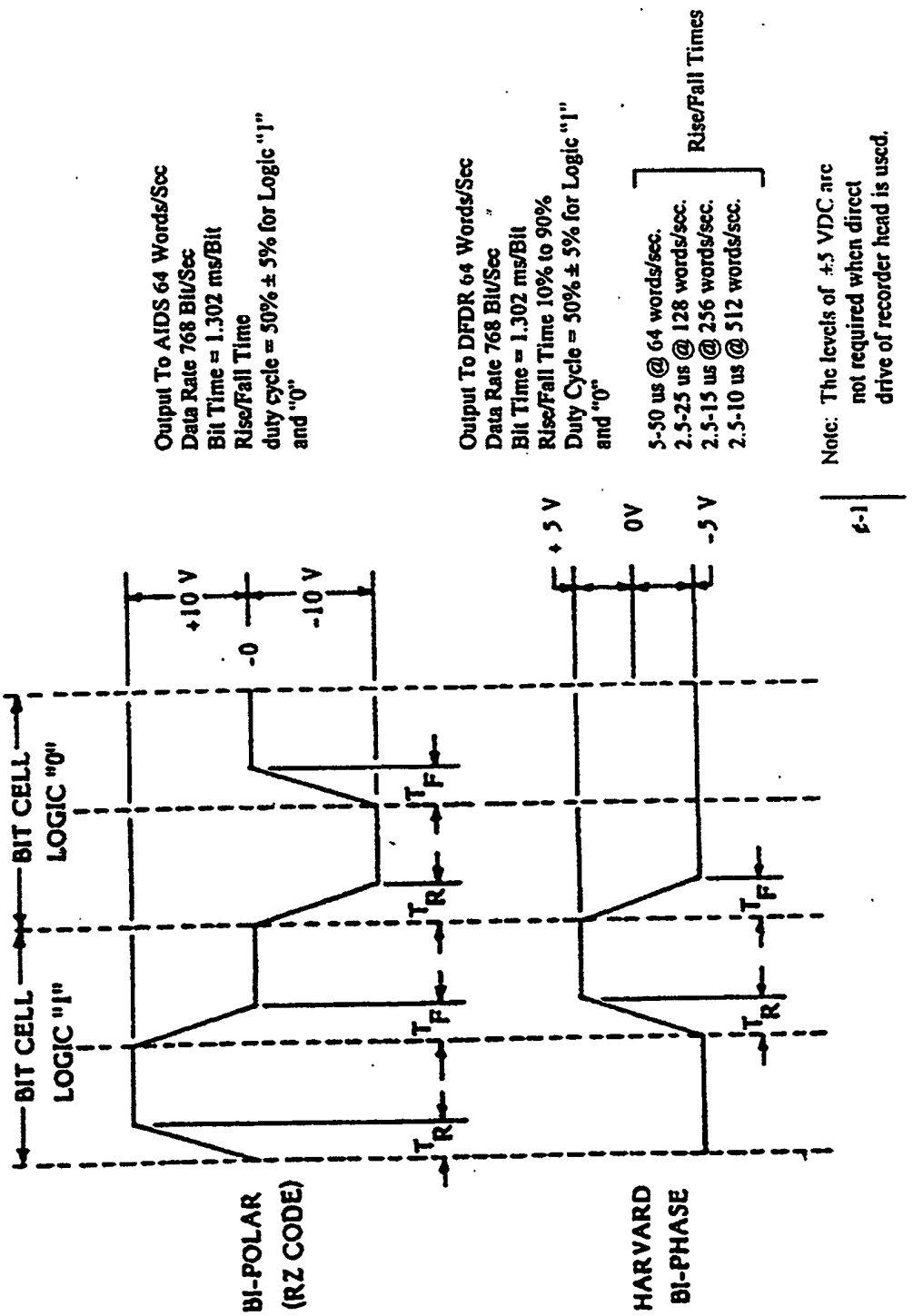
(5) Parity Bit

This bit is encoded to render word parity odd. Section 2.3.4 of ARINC 429 refers.

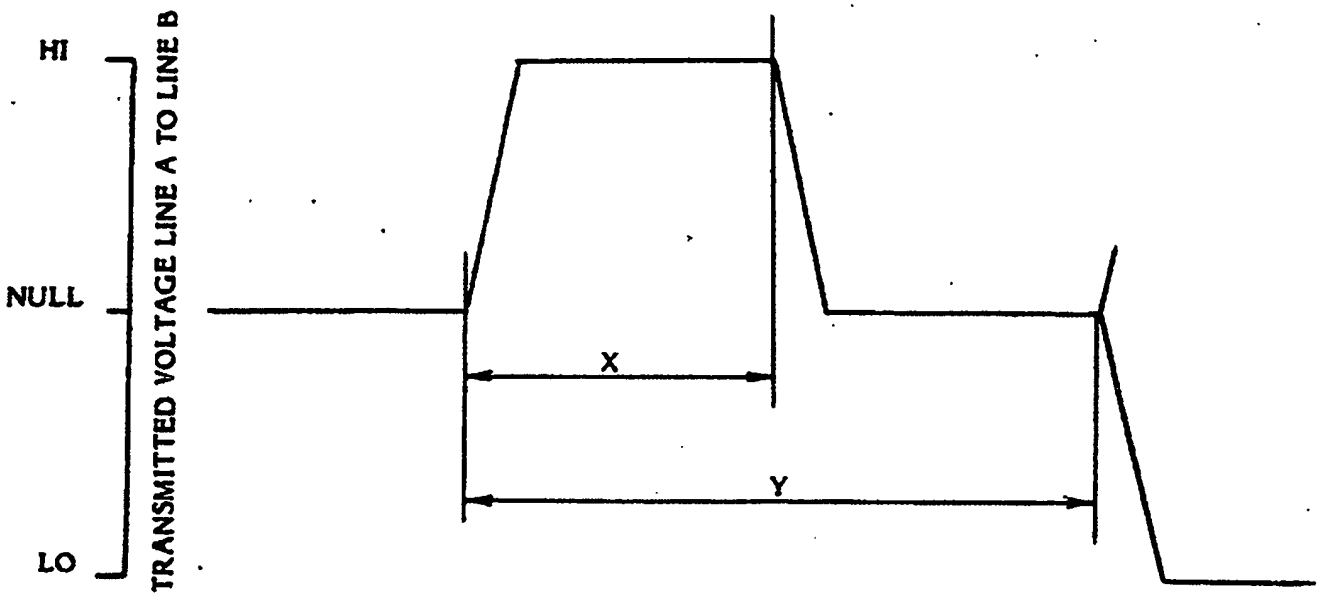
ATTACHMENT 9-2
DIGITAL DATA WAVEFORMS



ATTACHMENT 9-2 (Cont'd)
DIGITAL DATA WAVEFORMS



ATTACHMENT 9-3
ARINC 429 TIMING TOLERANCES



PARAMETER	HIGH SPEED OPERATION	LOW SPEED OPERATION
Bit Rate	100KBPS ±1%	12 - 14.5KBPS
Time Y	10 usec ± 2.5%	Z* usec ± 2.5%
Time X	5 usec ± 5%	Y/2 ± 5%
Pulse Rise Time**	1.5 ± 0.5 usec	10 ± 5 usec
Pulse Fall Time**	1.5 ± 0.5 usec	10 ± 5 usec

* $Z = \frac{1}{R}$ where R = bit rate selected from 12 - 14.5KBPS range

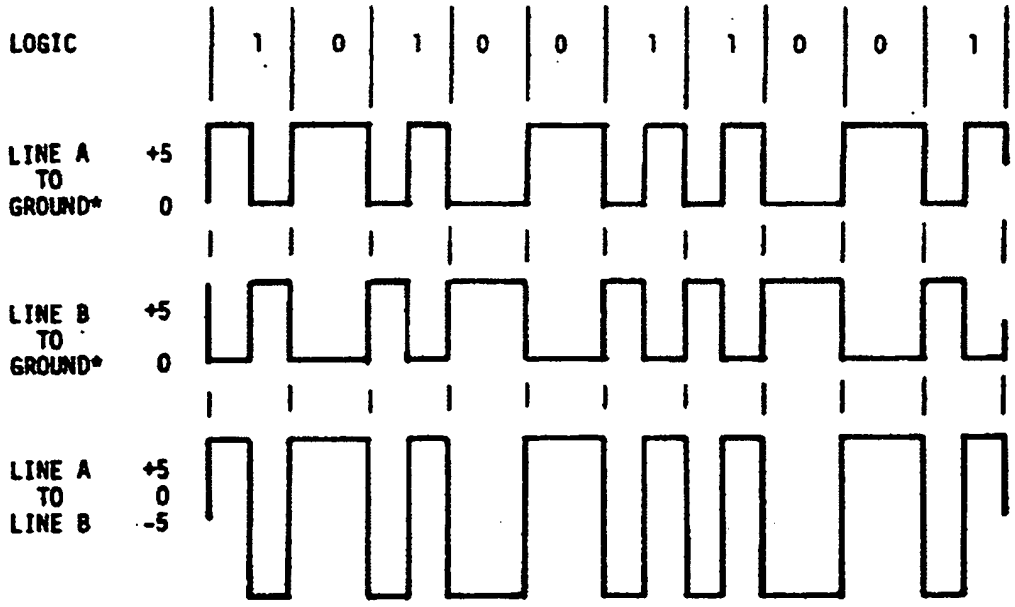
** Pulse rise and fall times are measured between the 10% and 90% voltage amplitude points on the leading and trailing edges of the pulse and include permitted time skew between the transmitter output voltages A-to-ground and B-to-ground.

ATTACHMENT 9-4
DIGITAL LOGIC LEVELS AND WAVEFORMS
(ARINC 717 HARVARD BI-PHASE CODE)

Tabulated Voltages and Tolerances

Circuit	Transmitted Voltages				Received Voltage			
	HI		LO		HI		LO	
	NOM	TOL	NOM	TOL	NOM	TOL	NOM	TOL
LINE A TO LINE B	+5	±1.0	-5	±1.0	+5	±3.0	-5	±3.0
LINE A TO GROUND*	+5	±0.5	0	±0.5	+5	±1.5	0	±1.5
LINE B TO GROUND*	0	±0.5	+5	±0.5	0	±1.5	+5	±1.5

OUTPUT LINE WAVEFORMS



NOTE 1: "*" Indicates DFDAU"Digital Signal Ground"

NOTE 2: The "A" and "B" sides of each digital circuit (data and word sync) should use twisted and shielded cable with an insulating jacket.

NOTE 3: Above voltages and Tolerances are for loads in the range of 3,000 to 12,000 ohms and do not apply where direct head drive is used in DFDR.

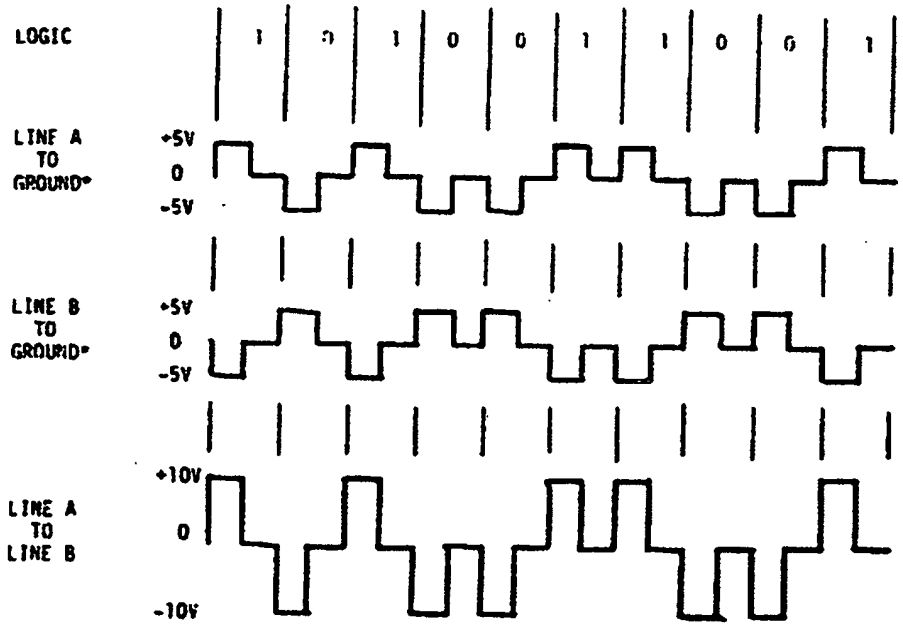
ATTACHMENT 9-5
"AUXILIARY OUTPUT" SIGNAL LOGIC LEVELS AND WAVEFORMS
(ARINC 429 BI-POLAR RZ CODE)

TABULATED VOLTAGES AND TOLERANCES

CIRCUIT	Transmitted Voltage				Received Voltage			
	ONE		ZERO		ONE		ZERO	
	NOM	TOL	NOM	TOL	NOM	TOL	NOM	TOL
Line A to Line B	+10	±1	-10	±1	+10	+3.0 -3.5	-10	+3.5 -3.0
Line A to Line B	+5	±0.5	-5	±0.5	+5	+1.5 -1.75	-5	+1.75 -1.5
Line B to Ground	-5	±0.5	+5	±0.5	-5	+1.75 -1.5	+5	+1.5 -1.75

←3

CIRCUIT LINE WAVEFORMS



NOTES:

1. "*" Indicates DFDAU Digital Signal Ground"
2. The "A" and "B" sides of each digital circuit (data and word sync) should use twisted and shielded cable with an insulating jacket. Neither side of the circuit should be grounded at any point in the aircraft interwiring or within the receiver device.

ATTACHMENT 9-6

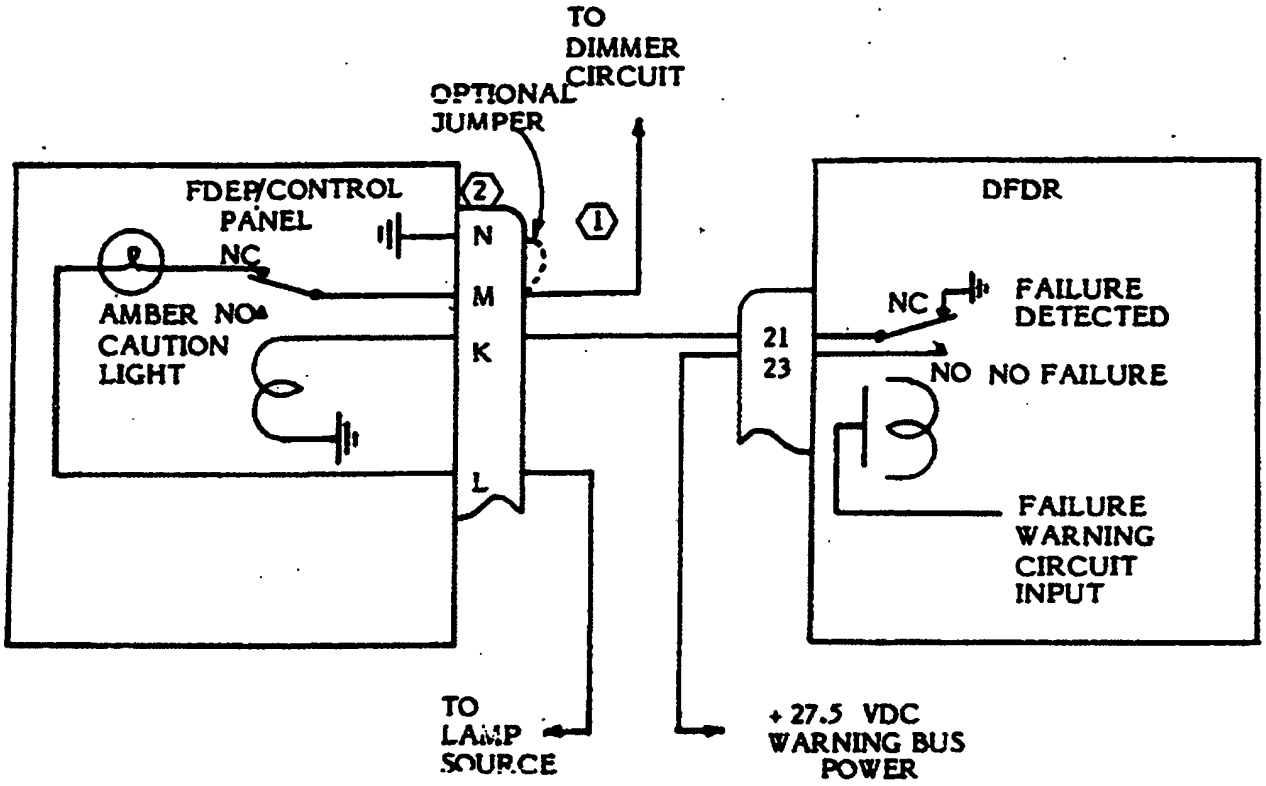
ATTACHMENT 9-6 HAS BEEN DELETED

ATTACHMENT 9-7

ATTACHMENT 9-7 HAS BEEN DELETED

Next Page Left Intentionally Left Blank

ATTACHMENT 10
INTERCONNECTIONS FOR FAILURE WARNING



USE AS ILLUSTRATION ONLY

(1) Since most commercial carriers use a dimmer circuit on the ground side of lamps, the circuit is configured accordingly. If a user were to elect not to use dimming on the warning indicators, a jumper from the lamp to ground may be connected as shown above. When the dimmer circuit is on the lamp source side of the indicator, the jumper must be connected.

(2) Pin assignments are those of Attachment 3-8 for the cockpit disconnect or the FDEP. The contr panel connector is an installation design option.

APPENDIX 1
AIDS BACKGROUND

General

The development of an AIDS spec was not an was task. An iterative process was the only means of generating a final version that would satisfy the needs of most users. Consequently, recommendations of the Subcommittee changed from meeting to meeting. In the timespan between the MSP General Session in May, 1978 and the DCA General Session in December, 1978 two Subcommittee meetings and one ad hoc meeting were held. The balance of this appendix will describe the major points of each meeting.

First S/C Meeting - July 25-27, 1978

The types of inputs to the DFDAU were discussed. The Subcommittee decided to retain the analog inputs in addition to digital inputs. Some analog inputs were deleted entirely and a few others were modified. Pin programmability provided for selection of digital buses and electrical characteristics of analog inputs.

The FDEP/DFDAU interface was discussed. The Subcommittee expressed the advantages of using a 429 "DITS" bus for the data transfer. The vendors, however, stated the difficulty of strict adherence to 429. The Subcommittee decided to let the FDEP/DFDAU data transfer system to the discretion of the vendors, but emphasized their preference of ARINC 429 being used.

The basic output format and synchronization was unchanged from that of Characteristic 573, but the types of information and the data word slot assignments differ from Characteristic 573. Word slots were not assigned at this meeting. An Ad Hoc meeting of the chairman, manufacturers, and airlines representatives would provide those assignments in the near future.

Ad Hoc Meeting - August 10-11, 1978

The meeting was held to resolve items not completed at the AIDS Subcommittee Meeting. The resolutions of the Ad Hoc meeting would be discussed at the next AIDS Subcommittee Meeting being held September 20-22, 1978.

Two sets of word assignments for the AIDS frame were generated at the meeting. One set of assignments encompassed the regulatory requirements of the CAA. Since the quantity of FAA requirements is comparatively low, those requirements were combined with the requirements of the other regulatory agencies to from the second set of slot assignments.

The programming scheme was discussed and modifications were made to the scheme suggested at the Subcommittee meeting. The new method of programming was less complicated and should have reduced the amount of hardware needed.

Second S/C Meeting - September 20-22, 1978

The AIDS Subcommittee decided to delete the concept of total flexibility and interchangeability attained by utilization of pin programming of parameters and instead to use a user-specified ROM to control word slot assignments and parameter input characteristics.

The minimum AIDS configuration (with a control panel only) was designated as the "standard" system for the purpose of standard interwiring definition. However, a disconnect in the airframe will allow the FDEP to be installed without the need to modify the standard interwiring.

A modified bottom insert for the LIF connector was suggested to provide enough pins for all AIDS inputs and outputs. The bottom insert recommended at the meeting contained 100 #22 pins.

DCA General Session – December 6-8, 1978

The Subcommittee's recommendation for a modified bottom insert was found unacceptable due to the additional tooling cost. Instead it was recommended that the ATE connections (planned for one bottom insert) be moved to a separate connector and the connections for the other bottom insert be moved to the top and middle inserts.

Another item that generated a significant amount of discussion was the retention of analog signal inputs. Some felt that AIDS now should be totally digital and although there would be analog signals aboard the aircraft, there could be an A/D converter attached to a signal cocentrator to provide a digital output. A system such as this would reduce the number of pins required for the LIF connector, but would require additional units external to the DFDAU. The idea was considered at the first Subcommittee meeting but was rejected, because of the cost and inconvenience of the additional unit. At the Subcommittee meeting the deed of a data concentrator by other systems was not realized. If a "standard" data concentrator evolved as a result of that need, perhaps it would not be unrealistic to consider its incorporation into AIDS. Although approval of the AIDS spec did not include a data concentrator, it will be considered in the future development of AIDS.

APPENDIX 2
BIBLIOGRAPHY

2.1 Bibliography

The following is a list of AEEC letters associated with the preparation of ARINC Characteristic 717.

LETTER	DATE	SUBJECT
78-049/AIDS-105	April 5, 1978	Circulation of United Airlines' Strawman for AIDS Spec update.
78-102/AIDS-106	August 22,1978	Report of AIDS Subcommittee Meeting held July 25-27, 1978 in Washington, D.C.
78-100/AIDS-107	August 21, 1978	Report of the Aircraft Integrated Data System (AIDS) Ad Hoc Meeting held August 10-11, 1978 at San Francisco, California
78-114/AIDS-108	September 1, 1978	Circulation of Draft 2, Project Paper 717, "Digital Expandable Flight Data Acquisition and Recording System (DEFDARS-AIDS Mark 3)
78-130/AIDS-109	October 6, 1978	Circulation of Draft 3 Project Paper 717, "Digital Expandable Flight Data Acquisition and Recording System (DEFDARS-AIDS Mark 3)
78-135/AIDS-110	October 20, 1978	Report of the Second "Aircraft Integrated Data System" (AIDS) Subcommittee Meeting Held September 20-22, 1978 at Los Angeles, California
78-142/AIDS-111	November 1, 1978	Circulation of Suggested Pin Assignments for Project Papaer 717, "Digital Expandable Flight Data Acquisition & Recording System (DEFDARS-AIDS Mark 3)"
79-009/AIDS-112	January 23, 1979	Adoption of Draft 3 of Project Paper 717 "Digital Expandable Flight Data Acquisition and Recording System (DEFDARS-AIDS Mark 3)"

2.2 Meeting Attendees

The following people attended one or more of the AIDS Subcommittee meetings held in July 1978 and September 1978:

AIRLINES/AEEC STAFF

J.S. Davidson	AIR CANADA	Montreal, Canada
C.L. Richmond	AMERICAN AIRLINES	Tulsa, Oklahoma
Tom O'Kane	BRITISH AIRWAYS	London, England
Peter Waller	BRITISH AIRWAYS	London, England
Samuel A. Kotey	KLM ROYAL DUTCH AIRLINES	Amsterdam, Netherlands
Henk C. Vermeulen	KLM ROYAL DUTCH AIRLINES	Amsterdam, Netherlands
Peter Ladwig	LUFTHANSAGERMAN AIRLINES	Hamburg, Germany
Jensen Jorgen	SCANDINAVIAN AIRLINES	Stockholm-Bromma, Sweden
A. Vernblad	SCANDINAVIAN AIRLINES	Stockholm-Bromma, Sweden
Gerald G. West	SOUTH AFRICAN AIRWAY	Benoni, South Africa
Malcolm J. Whyte	SOUTH AFRICAN AIRWAYS	Rep. of South Africa
Robert Luscher	SWISSAIR	Kloten, Switzerland
Frank E. Miller	TRANSWORLD AIRLINES	Kansas City, Missouri
U. Gustafsson	UNITED AIRLINES	San Francisco, California
F.L. Mohr	UNITED AIRLINES	San Francisco, California
B.R. Climie	AERONAUTICAL RADIO, INC.	Annapolis, Maryland
D.A. Martinec	AERONAUTICAL RADIO, INC.	Annapolis, Maryland

Manufacturers and Others

David R. Brush	BOEING	Seattle, Washington
George Dagnall	BOEING	Seattle, Washington
Henry Curran	BRITISH AEROSPACE	Hatfield, England
James M. Robbins	DOUGLAS AIRCRAFT	Long Beach, California
John N. Ellis	EMM/SESCO	Chatsworth, California
Elton L. Kavanagh	EMM/SESCO	Chatsworth, California

APPENDIX 2 (cont'd)
BIBLIOGRAPHY

2.2 Meeting Attendees (cont'd)

John Cucchi	HAMILTON STANDARD	Windsor Locks, Connecticut
Richard D. Haley	HAMILTON STANDARD	Windsor Locks, Connecticut
Leigh Holt	HAMILTON STANDARD	Windsor Locks, Connecticut
Ivor Hughes	HAMILTON STANDARD	Windsor Locks, Connecticut
Melvin Perkins	HAMILTON STANDARD	Windsor Locks, Connecticut
D. W. Althaus	LOCKHEED AIRCRAFT SERV.	Ontario, California
Garth Hess	LOCKHEED AIRCRAFT SERV.	Ontario, California
Vito Scalisi	LOCKHEED AIRCRAFT SERV.	Ontario, California
William R. Beckman	LOCKHEED -CALIFORNIA CO.	Burbank, California
W. F. Wall	LOCKHEED GEORGIA CO.	Marietta, Georgia
Charles Meissner	NASA-LANGLEY RES. CTR.	Hampton, Virginia
Malcolm Burgess (observer)	NTSA/BUR. OF TECHNOLOGY	Washington, D.C.
C. A. Roberts (observer)	NTSA/BUR. OF TECHNOLOGY	Washington, D.C.
R. Rutherford	PLESSEY CO., LTD.	Hampshire, England
Kenneth Derbyshire	ROCKWELL INTERNATIONAL	Los Angeles, California
Frederick H. Gardner	ROCKWELL INTERNATIONAL	Los Angeles, California
Thomas A. Hait	ROCKWELL INTERNATIONAL	Los Angeles, California
John A. Amend	SUNDSTRAND DATA	Redmond, Washington
R. D. Angeledes	SUNDSTRAND DATA	Redmond, Washington
Del Renner	SUNDSTRAND DATA	Redmond, Washington
Edward Stephanson	SUNDSTRAND DATA	Redmond, Washington
Larry Fox	TELEDYNE CONTROLS	El Segundo, California
George Orendy	TELEDYNE CONTROLS	El Segundo, California

DIRECTION GENERALE
DE
L'AVIATION CIVILE

TELEX : 670[illegible] STATEC PARIS

PAR AVION

PARIS LE 30 JUIN 1980

NOTRE "ENTRETIEN"

TEL. 233.44.65 P. 384

TELEX 55267

VOTRE

Sundstrand Data Control Inc
à l'attention de M.R. L.D. MILLER
Senior Product Manager
Overlake Industrial Park.Redmond
Washington 98052
U.S.A.

OBJET : deuxième fixation des enregistreurs de vol.

Monsieur le Directeur,

Votre courrier ci-dessus référencé a retenu toute mon attention.

Les conditions techniques françaises exigent qu'une seconde fixation "doit permettre aux enregistreurs de rester solidaires de la cellule de l'avion après rupture de la première fixation". Il est bien évident que le moyen de satisfaire à cette exigence dans les conditions réglementaires d'environnement est de la responsabilité du constructeur.

Par contre la réglementation française n'exige pas actuellement qu'un ULB soit monté sur les enregistreurs de vol, il s'agit d'une exigence d'origine américaine.

Pour satisfaire les deux réglementations (FAA et DGAC) les deux exigences doivent être conjuguées, c'est ce qu'indique le document ARINC 717.

Je joins à ma lettre le texte réglementaire français.

Veuillez agréer, Monsieur le Directeur, l'expression de ma considération distinguée.

L'Ingénieur de l'Aviation Civile
Chef de Bureau Matériels Aéronefs

J.M. SANSOVINI

COURRIER: 93, Boulevard de Montparnasse - 75270 PARIS CEDEX 06

DECISION

Portant modification de la décision d'application de l'arrêté du 28 mai 1975 relatif aux systèmes enregistreurs de vol.

Le Secrétaire d'Etat aux Transports,

Vu l'arrêté du 28 mai 1975 relatif aux systèmes enregistreurs de vol,

Vu la décision d'application du 28 mai 1975 relative aux systèmes enregistreurs de vol,

DECIDE

ARTICLE 1er

L'alinéa 9.1. du paragraphe 9 intitulé "fixation des enregistreurs" de l'article 4 de la décision d'application de l'arrêté du 28 mai 1975 relatif aux systèmes enregistreurs de vol est annulé et remplacé par le suivant :

"La première fixation doit permettre à l'enregistreur de rester solidaire de la cellule de l'aéronef sous une accélération longitudinale, transversale ou normale aussi élevée que possible, et, en tout cas, au moins égale à la valeur exigée par les normes en vigueur pour la tenue des fixations des équipements montés à bord des aéronefs."

ARTICLE 2

La présente décision est applicable à compter de la date de sa publication.

ARTICLE 3

Le Directeur Général de l'Aviation Civile est chargé de l'exécution de la présente décision.-

FAIT A PARIS, le 16 AOUT 1976

Pour le secrétaire d'Etat et par délégation : le Sous-Directeur Technique

C. [illegible]

4. *Fonctionnement en vol.*

L'enregistrement des paramètres devra être effectué dès qu'un moteur au moins sera en fonctionnement.

L'enregistrement des conversations et alarmes sonores devra permettre de restituer les opérations préliminaires à un vol et consécutives au vol précédent dans les limites de l'autonomie de l'enregistreur.

5. *Emplacement des dispositifs signalant le fonctionnement défectueux et permettant de placer des repères.*

Ces dispositifs doivent être placés dans le poste de pilotage et facilement accessibles à l'équipage.

6. *Emplacement du microphone dans le poste de pilotage.*

Le microphone doit être installé de telle façon que l'enregistrement des conversations du commandant de bord, du deuxième pilote et des autres membres de l'équipage se fasse dans les meilleures conditions possibles, quel que soit le niveau de bruit régnant normalement dans le poste de pilotage.

7. *Emplacement des ensembles d'acquisition de données.*

Ces ensembles doivent être installés dans les compartiments spécialisés, en accord avec les normes en vigueur relatives aux installations des matériels à bord.

8. *Emplacement des enregistreurs.*

Le ou les enregistreurs doivent être installés le plus à l'arrière possible de l'aéronef à l'endroit où ils risquent d'être le moins endommagés en cas d'accident, mais pas nécessairement en zone pressurisée.

L'emplacement de l'enregistreur doit être repéré sur la paroi extérieure de l'aéronef par la mention suivante en lettres rouges de 2,5 centimètres de hauteur :

ATTENTION, ICI ENREGISTREURS DE VOL
CAUTION, FLIGHT RECORDERS HERE

9. *Fixation des enregistreurs.*

Le ou les enregistreurs doivent être fixés à la cellule de l'aéronef par deux fixations indépendantes.

9.1. La première fixation doit permettre à l'enregistreur de rester solidaire de la cellule de l'aéronef sous une accélération longitudinale, transversale ou normale de 250 m/s².

9.2. A compter du 1er avril 1976, la seconde fixation devra permettre aux enregistreurs, que l'on déclenche d'une masse nominale de 15 kg, et dans la mesure où ils ne sont pas éjectables, [illegible] Elle devra pouvoir remplir ces fonctions dans les conditions suivantes :

— vitesse initiale maximale de séparation « enregistreur-cellule » : 100 m/s ;
— décélération maximale appliquée aux enregistreurs : 250 m/s².

Cette seconde fixation, dont la durée de vie ne pourra être inférieure à dix-huit mois, devra pouvoir remplir sa fonction dans un domaine de températures compris entre — 20 °C et + 70 °C après avoir été soumis aux contraintes cycliques climatiques et mécaniques (vibrations, accélérations) généralement admises pour les équipements de bord situés ou non en zone pressurisée.

Il n'est pas exigé que cette fixation soit ininflammable.

10. *Emplacement et fixation des accéléromètres.*

Les capteurs d'accélération normale, transversale et longitudinale doivent être placés aussi près que possible de la position moyenne du centre de gravité de l'aéronef.

La fixation des capteurs d'accélérations à la structure de l'aéronef devra minimiser les perturbations possibles des mesures d'accélérations.

Article 2.

Conditions d'approbation du système enregistreur de vol par les services officiels français.

1. *Conception du système.*

Le système enregistreur de vol doit être conçu pour permettre :
— l'enregistrement des paramètres, avec les caractéristiques mentionnées à l'article 6 de la présente décision ;
— l'enregistrement des conversations et alarmes sonores, mentionnées à l'article 7 de la présente décision ;
— le placement de repères par l'équipage sur l'enregistrement des paramètres ;
— la signalisation du fonctionnement défectueux des enregistreurs à l'intention de l'équipage.

2. *Placement de repères sur l'enregistrement de paramètres.*

Ce dispositif doit permettre de repérer l'heure à laquelle un événement a été décelé par l'équipage.

3. *Signalisation du fonctionnement défectueux des enregistreurs.*

Ce dispositif doit permettre à l'équipage de vérifier que :
— le défilement du support d'enregistrement est normal ;
— le dispositif d'écriture est alimenté.

4. *Caractéristiques des enregistreurs.*

4.1. Synchronisation.

4.1.1. Lorsque l'enregistrement est effectué sur plusieurs canaux la synchronisation entre deux quelconques d'entre eux doit pouvoir être effectuée avec un décalage inférieur à 1/16 s.

4.1.2. L'enregistrement des paramètres et celui des conversations et alarmes sonores doivent être synchronisés à une seconde près. Cette synchronisation peut être réalisée par l'enregistrement de top pendant toute la durée des liaisons radio « air-sol ».

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 1
TO
ARINC CHARACTERISTIC 717
FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: November 16, 1979

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: August 30, 1979

A. PURPOSE OF THIS SUPPLEMENT

This Supplement provides for the addition of an optional digital concentrator port, a printer I/O and eight DITS ports. Among the items deleted from the original version of Characteristic 717 are the clock synch input and output, and the reference to an MS 3122 connector. Other changes have been made to the sections concerning AC Discretes, power interrupts, cooling, DITS port assignments, ATE and Standard interwiring.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and, where appropriate, extracts from the original text for comparison purposes. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "¢-1" symbols in the margins. Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-1 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition of change and, for other than very minor revisions, any text originally contained in the Characteristic is reproduced for reference.

1.4.1 DIGITAL FLIGHT DATA ACQUISITION UNIT (DFDAU)

Text revised to alter format of Auxiliary Output.

ORIGINAL TEXT FOLLOWS:

1.4.1 Digital Flight Data Acquisition Unit (DFDAU)

The Digital Flight Data Acquisition Unit (DFDAU) contains the circuitry necessary for the acquisition, conditioning, and conversion of sensor signals of interest to the user. It is expected that the DFDAU functions are processor controlled.

Sampling sequence of the flight data parameters is determined by a read-only-memory (ROM) which is specified for each application by the user. This ROM completely controls all signal programming as to input pin assignments, type of signal and data frame assignment.

Two digital data output circuits are specified to the be provided from the Digital Flight Data Acquisition Unit. Each of the two specified outputs should consist of serial twelve - bit words, always with the least significant bit (LSB) transmitted first and with a data rate and modulation as follows:

FLIGHT RECORDER UNIT - Data rate of 64 words per second formatted into a frame of four sub-frames of 64 words each. Electrical format should be Harvard Bi-Phase modulation.

AUXILIARY OUTPUT - Data format identical to the flight recorder output but electrical format should be Bi-polar modulation

ARINC Characteristic 717-1 contains the initial printing of Supplement 1. Supplement 1 is not available separately.

1.4.1 Digital Flight Data Acquisition Unit (DFDAU) (cont'd)

COMMENTARY

In an expanded system, or for engineering test; a cassette type quick access recorder may be installed with the data processed separately from flight recorder data. Using the separate auxiliary output ensures that this extra recorder does not compromise the critical flight recording.

In addition to these outputs, there are pins set aside for an optional high-speed output for possible use in an expanded system.

The detailed characteristics of the DFDAU are shown in Section 5.

1.4.5 PRINTER (OPTIONAL)

Text added to describe printer interface with AIDS and other systems.

2.8 ABNORMAL CONDITIONS

New section added to provide a description of equipment reaction to abnormal power conditions and loss of cooling.

3.2 SYSTEM INTERWIRING

Text was changed to describe the accessibility of the disconnect.

ORIGINAL TEXT FOLLOWS:

3.2 System Interwiring

The system interwiring shown in Attachment 2 is required for all original installations, regardless of aircraft or unit manufacturer. It will ensure that there is wiring for proper interconnection of all the basic units, allowing all the flexibility of the basic design described in this Characteristic.

There should be complete wiring between the DFDAU and a connector in the cockpit. This connector should be in the flight engineer's area and should in turn connect to the control panel and/or to the optional FDEP.

4.2.7 RESISTANCE (90.38 OHM) (3-WIRE)

Title changed to reflect reference to 4-wire probe.

4.3.1 LABELED AIRCRAFT DATA

The SDI code was changed to conform with ARINC 429.

ORIGINAL TEXT FOLLOWS:

4.3.1 Labeled Aircraft Data

Aircraft data using DITS format will have labels identifying the data. The DFDAU should decode the labels and the Source/Destination Identifier (SDI) for all DITS data in the customer assigned data words. For instance, airspeed may be recorded with 10 bits as word 19 of all subframes with the data taken from Air Data System 2. The DFDAU will see the DITS word addressed as octal 206, SDI binary 10, reading bits 18-27 using bit 17 to round.

A recommended listing of primary label-decoded data assigned by ports is in Attachment 6

4.3.4 CLOCK/SYNC INPUT

Text deleted. Section 4.3.5 moved in place of Section 4.3.4.

ORIGINAL TEXT FOLLOWS:

4.3.4 Clock/Sync Input

The DFDAU should be capable of operating from an external clock synch provided by another DFDAU, a special computer unit or other utilization device. Loading of the DFDAU input should be per Attachment 9-6.

The clock/synch input should be insensitive to transients with amplitude/durations of 50 microsecond-volts, and of positive or negative polarity.

4.4.3 AC SENSITIVE DISCRETE

Text amended to reflect change of definition for open circuit condition.

ORIGINAL TEXT FOLLOWS:

4.4.3 AC Sensitive Discrete

Range: 0 to 120 V, AC or DC
State 1 is defined as any voltage greater than 18 volts.
State 0 is defined as any voltage less than 7 volts.

An open circuit is undefined.

COMMENTARY

These three classes of discretes utilize voltage levels to define the two binary states. One uses an AC or DC voltage signal and the other two use only DC signals. For many purposes, they may be used interchangeably, where the aircraft discrete being monitored has a low impedance in both State 1 and State 0. The difference between them shows an open input line. The two DC sensitive discretes have defined open states, the AC does not.

The "series" discrete draws current out of the source when in State 1, and may, therefore, be used where a switching device in the sensor interrupts the voltage. The "shunt" discrete draws current from the DFDAU in State 0, and may, therefore, be used with any switch to ground. The "shunt" discrete is particularly intended for grounded switches requiring diode isolation, for example, press-to-test. The ARINC 573 ratio of 3 to 1 for series/shunt switch quantities has been retained.

There is a need in certain cases to monitor the presence of an AC voltage. A special input, as in Section 4.4.3, is the only way to combine this need with the impossibility of a simultaneous firm definition of the open state. After all, the noise to be filtered off the open line may be of the same 400 Hz to be monitored.

4.4.4 TIMED DISCRETES

Text providing detailed description of timed discretes was deleted.

ORIGINAL TEXT FOLLOWS:

4.4.4 Timed Discretes

Some of the discretes of 4.4.1-4.4.3 should be Timed Discrete inputs. Each Timed Discrete input should be clocked in eighths of a second in real time from the last occurrence of word one, bit one (beginning of subframe), using three bits of data for each time count.

If a Timed Discrete is open at the beginning of the subframe the timing should be to closure, if closed at the beginning of the subframe the timing should be to opening.

The count should be output as a data word of all subframe with Timed Discrete #1 in bits 1-3, #2 in bits 4-6, #3 in bits 7-9, and #4 in bits 10-12.

If a Timed Discrete input is open at both the beginning of a subframe and at the end of word 64 of the same subframe, its data should be all zeroes; if closed, it should be all ones.

For example, If the switch was not on in the last subframe, (its count was zero and the discrete data was zero) and in the following three subframes the counts are 3, 7, 5, respectively, then the switch came on 438 milliseconds after the start of the first of those three subframes and it stayed on for two seconds 250 milliseconds. Both times are $\pm$ 63 milliseconds. Both times are $\pm$ 63 millisecond (1/16 sec.)

COMMENTARY

The Timed Discrete switches may be used to time the duration of any discrete event or the relative timing between several events. It should be noted that the shortest duration or interval that can be captured is one eighth of a second but it cannot be certain to capture an event shorter than one full second with only one switch.

4.7.2 AUXILIARY OUTPUT

Text revised to permit user-specified format.

ORIGINAL TEXT FOLLOWS:

4.7.2 Auxiliary Output

The auxiliary output carries the same data as the DFDR output but is modulated in Bi-polar coding per Attachment 9-5 and Section 5.3.

4.7.5 CLOCK/SYNCH OUTPUT

Text deleted.

ORIGINAL TEXT FOLLOWS:

4.7.5 Clock/Synch Output

A Clock/Frame Synch Output should be provided from the DFDAU to synchronize the FDEP, another DFDAU or other using or feeding equipment with the DFDAU as required. This signal should be present in both an internally and an externally clocked DFDAU.

The Clock/Synch Output, the waveform and the relative timing with the output should be as shown in Attachment 9-6 and 9-7.

5.3.2 DFDR OUTPUT DATA BUS

Text added to facilitate direct connection of DFDAU recorder head.

ORIGINAL TEXT FOLLOWS:

5.3.2 DFDR Output Data Bus

This output should be sequenced in full accordance with Section 5.3.1. It should consist of 64 12-Bit words per second at a bit rate of 768 bits per second in Harvard bi-phase coding.

5.3.3 AUXILIARY OUTPUT

Text amended to provide user specification of output format.

ORIGINAL TEXT FOLLOWS:

5.3.3 Auxiliary Output

This output should be sequenced in full accordance with Section 5.3.2 identical to the DFDR output but in bi-polar electrical coding.

COMMENTARY

Some airlines see a need to connect a quick access (cassette type) recorder to the DEFDARS for certain flight tests or such a recorder is fitted as part of an expanded system. This recorder will be connected to the auxiliary output to ensure the integrity of the flight recording.

5.4 EXTERNAL DFDAU CLOCK AND SYNCHRONIZATION

Text deleted. This section replaced with description of optional digital port.

ORIGINAL TEXT FOLLOWS:

5.4 External DFDAU Clock and Synchronization

If the external clock of Section 4.7.5 is present on the DFDAU clock/synch input, the DFDAU output should be in synchronization with respect to frame and bit synchronization provided by this external clock signal as detailed in Attachment 9-7.

In the absence of the external clock, the DFDAU should automatically operate on its internal clock.

9.2 UNIT IDENTIFICATION

Text amended to provide description of ATE connections in a service insert rather than the usual reserved ATE insert.

ORIGINAL TEXT FOLLOWS:

9.2 Unit Identification

Six pins on the ATE connector insert should be reserved for the implementation of a "resistance coding" scheme for unit identification by the ATE, in which a 1% tolerance resistor is connected from each pin to a common ground in a "star" formation. Values selected should correspond to the standard 10% increments in resistance ;in order to prevent ambiguities resulting from tolerance build-up and aging. The power handling capability of each resistor need not exceed 0.1 watt.

9.2.1 PIN ALLOCATION

Pin assignments changed.

ORIGINAL TEXT FOLLOWS:

9.2.1 Pin Allocation

Two pins should be allocated to each of the following functions and one pin to the "star formation common" (i.e., DC chassis ground).

TP1A-TP1B Manufacturer Identification (Resistor values to be registered with ARINC when selected)

TP1C-TP1D Part No. or Type No. of the equipment.

TP2A-TP2B Modification Status of the Equipment

TP2C Network Common (Resistor "star" point)

ATTACHMENT 1: SYSTEM BLOCK DIAGRAM

DFDAU Clock and Synch lines deleted.

ATTACHMENT 2-1: SYSTEM STANDARD INTERWIRING

DFDAU Clock and Synch lines deleted. Cockpit disconnect and Control Panel shown separately.

ATTACHMENT 2-2: STANDARD INTERWIRING

Interwiring revised to accommodate addition of new I/O and the deletion of obsolete I/O.

ATTACHMENT 3-2: DFDAU PIN ASSIGNMENTS

Detailed layouts of inserts added.

ATTACHMENT 3-8: COCKPIT DISCONNECT AND DATA ENTRY PANEL PIN ASSIGNMENT

Title and Note 3 changed to avoid direct specification of connector type for cockpit disconnect.

ORIGINAL TEXT FOLLOWS:

The cockpit disconnect receptacle is type MS3122E20-415 or equivalent and is wired to the Control and or FDEP lug. An equivalent connector will mate with those given above.

ATTACHMENT 5-1: INPUT CONNECTOR PIN ASSIGNMENT STANDARDS

Connector pin "b" assignment changed from "OPEN" TO "C" on potentiometer and resistance probe.

ATTACHMENT 6: SUMMARY OF DITS INPUT ASSIGNMENTS

The columns for "Recommended Label", "Recommended Parameter" and Samples/Sec" deleted. SDI codes changed to conform with ARINC 429. Assignments of ports 10-16 were deleted and AHRS reassigned to port 15 from port 6. Table expanded to accommodate optional ports 17-24.

ATTACHMENT 7: GUIDANCE FOR INPUT ISOLATION

AC Sensitive values changed from 150K and 30 microamp to 20K and 500 microamp respectively.

ATTACHMENT 9-2: DIGITAL DATA WAVEFORMS

Note added.

ATTACHMENT 9-6: CLOCK/FRAME SYNCHRONIZATION OUTPUT

Deleted.

ATTACHMENT 9-7: SYNCHRONIZATION TIMING TOLERANCES

Deleted.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 2

TO

ARINC CHARACTERISTIC 717

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: July 29, 1980

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: June 18, 1980

A. PURPOSE OF THIS SUPPLEMENT

This supplement provides for the addition of the capability for the DFDAU to process strain gauge and thermocouple input signals, the clarification of the optional port use, redefinition of the Ident discrete assignments, modification of the sensitivity deviation reference, addition of a note on the DGAC secondary structure and reservation of test pins on the accelerometers.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and, where appropriate, extracts from the original text for comparison purposes. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "¢-2" symbols in the margins Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-2 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition or change and, for other than very minor revisions, any text originally contained in the Characteristic is reproduced for reference.

4.2 ANALOG DATA INPUTS

Text added concerning addition of thermocouple and strain gauge inputs.

ORIGINAL TEXT FOLLOWS:

4.2 Analog Data Inputs

The following types of analog signals should be accepted by the DFDAU. In cases where a reference or excitation voltage is stated, the value given is the nominal. For all types of signals the digital value should be linear with the input over the entire specified range.

The synchro inputs should be programmed to use the proper reference signal. There are five reference voltage inputs using the AC ground for return. The five references should alwalys include the three phases of the aircraft power generating system with the other two inputs to be used for reference voltages from special equipment as needed for each installation.

The AC ratio reference signals are expected to meet the standards for the ARINC 407 26VAC reference.

4.2.8 STRAIN GAUGE

New section inserted.

4.2.9 THERMOCOUPLE

New section added.

4.4.6 IDENT INPUTS

Pin assignments revised.

ORIGINAL TEXT FOLLOWS:

4.4.6 Ident Inputs

There should be 19 input pins which will be used for identification purposes. Five pins will identify the aircraft type and the codes used should be registered with ARINC. Five pins will be airline coded fleet identification, eight will be airline coded identification of individual aircraft and one will be identification common.

Each of these will be coded by being either open or connected to the identification common pin. The connection to identification common should indicate the "one" state. See Attachment 5-3.

5.4 OPTIONAL DIGITAL PORT

Text changed to clarify label assignments.

ORIGINAL TEXT FOLLOWS:

5.4 Optional Digital Port

The user may specify the need for a port that provides the digital equivalent of the analog input values. The port should have an output format corresponding to ARINC 429. The parameters to be available at this output port should be controlled by the user-specified software.

7.3.3.2 SENSITIVITY

Sensitivity variation text modified to be with reference to one degree Fahrenheit.

7.3.3.2 Sensitivity

The output signal levels or sensitivities in Section 7.3.1 should not change by more than 0.01% (of the full range output value) over the temperature range of -65 to +160°F.

9.2.2 Use of ATLAS LANGUAGE

Reference changed to ARINC Specification 616.

ORIGINAL TEXT FOLLOWS:

9.2.2 Use of ATLAS Language

Equipment manufacturers should note that the airlines desire to have the DEFDARS test procedures intended for execution by automatic test equipment written in the ATLAS language described in IEEE Standard 416-1976.

ATTACHMENT 2-2 - DFDAU STANDARD INTERWIRING

Former spare pins LTP4A-LTP4K, RTP4A-RTP4K, LTP6A, LTP6B, RTP6A and RTP6B assigned to thermocouple inputs.

Former spare pins LTP6C-LTP6K, RTP6C-RTP6K, LTP8A-LTP8H and RTP8A and RTP8H assigned to strain gauge inputs.

Former spare pins LTP8J, RTP8J, LTP8K, RTP8K, LTP10A, RTP10A, LTP10B and RTP10B assigned to strain gauge excitation outputs.

ATTACHMENT 3-2 -DFDAU PIN ASSIGNMENTS

Pin assignments made as per changes to Attachment 2-2.

ATTACHMENT 3-3 - DFDR STRUCTURE PROVISION

Note expanded to cover location problem with the Underwater Locater Beacon (ULB)

ATTACHMENT 3-6 - ACCELEROMETER PIN ASSIGNMENT

Pins J and K previously assigned as "Spares" are now assigned as "Reserved" for supplier-specified test signals.

ATTACHMENT 5-3 - SUMMARY OF DISCRETE INPUT ASSIGNMENTS

Fleet Ident discrete reassigned to A/C Type discrete.

ATTACHMENT 5-4 - IDENT DISCRETE ASSIGNMENTS

Table added for A/C type assignments in discretes 82-87.

APPENDIX 3 - DGAC REGULATIONS ON SECONDARY ATTACHMENTS

Text added.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 3

TO

ARINC CHARACTERISTIC 717

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: March 27, 1981

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: March 13, 1981

A. PURPOSE OF THIS SUPPLEMENT

This Supplement introduces a revised commentary for the marker beacon discrete, modified tolerances for the auxiliary output voltages, additional pin assignments for special-purpose recorders, definition of reaction to bus faults, and the deletion of synchronization voltage specifications.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and, where appropriate, extracts from the original text for comparison purposes. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "¢-3" symbols in the margins. Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-3 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition or change and, for other than very minor revisions, any text originally contained in the Characteristic is reproduced for reference.

4.2.1 SYNCHRO SIGNAL

Maximum reference voltage added.

ORIGINAL TEXT FOLLOWS:

4.2.1 Synchro Signal

Range:	0 to 360 degrees (continuous unlimited rotation)
Voltage:	11.8 VAC line to line
Reference Voltage:	26 VAC 400 Hz
Digital Scaling:	0 degrees is zero count and 360 degrees is full count plus an additional binary 1, i.e., all zeros.
Accuracy:	±0.17% (0.6 degrees)

4.2.1 Synchro Signal (cont'd)

COMMENTARY

All synchro signals should conform to the standards set forth in ARINC 407.

AIDS designers should note that the reference or excitation voltage for the synchro signals (H) is provided as an input because the various synchros are normally connected to special instrumentation power buses. These buses are normally supplied from different alternators and/or phases than that used for DEFDARS primary power.

4.2.2 AC VOLTAGE RATIO 1

Maximum reference voltage added.

ORIGINAL TEXT FOLLOWS:

4.2.2. AC Voltage Ratio 1

Range	0 to 5VAC-in and out of phase referenced to 26VAC 400 Hz excitation
Digital Scaling:	5 VAC out of phase is zero count and 5 VAC in phase is full count
Accuracy:	±0.2% (20 m VAC, nominally

4.2.3 AC VOLTAGE RATIO 2

Maximum reference voltage added.

ORIGINAL TEXT FOLLOWS:

4.2.3 AC Voltage Ratio 2

Range:	0 to 26 VAC - in and out of phase referenced to 26 VAC 400 Hz excitation
Digital Scaling:	26 VAC out of phase is zero count and 26 VAC in phase is full count
Accuracy:	± 0.2% (104 mVAC nominally)

4.3.5 BUS FAULT PROTECTION

New section added.

4.4.5 MARKER BEACON DISCRETE

Commentary expanded.

ORIGINAL TEXT FOLLOWS:

4.4.5 Marker Beacon Discrete

Frequency Range:	400-3000 Hz
Duration:	1 to 10 seconds
Modulation:	60% on, 40% off
Waveform:	Crest factor 4.0 maximum
Range:	0 to 7V RMS

State 1 is defined as any voltage greater than 2.5 V RMS.

State 0 is defined as any voltage less than 1.5 V RMS.

4.4.5 Marker Beacon Discrete (cont'd)

COMMENTARY

These input signals are supplied by the three lamp outputs from the Marker Beacon receiver. There are no industry standards which define these signals. Thus, designers will need to do some individual "homework" to ensure compatibility with the receivers now in use. The circuits designed for ARINC 573 all worked well.

ATTACHMENT 2-2 - DFDAU STANDARD INTERWIRING

Pins LTP2J, LTP2K and LTP10C-LTP10F changed from spare to special purpose recorder assignments.

Pins LTP10G-LTP10K and LTP12A-LTP12K changed from spare to non-standard functions.

ATTACHMENT 3-2 - DFDAU PIN ASSIGNMENTS

Pins LTP2J, LTP2K and LTP10C-LTP 10F changed from spare to special purpose recorder assignments.

Pins LTP10G-LTP10K and LTP12A-LTP12K changed from spare to non-standard functions.

ATTACHMENT 9-5 - "AUX OUTPUT" SIGNAL LOGIC LEVELS AND WAVEFORMS

Received voltages revised to match ARINC 429 (editorial).

Sync voltages deleted (editorial).

Original material on next page.

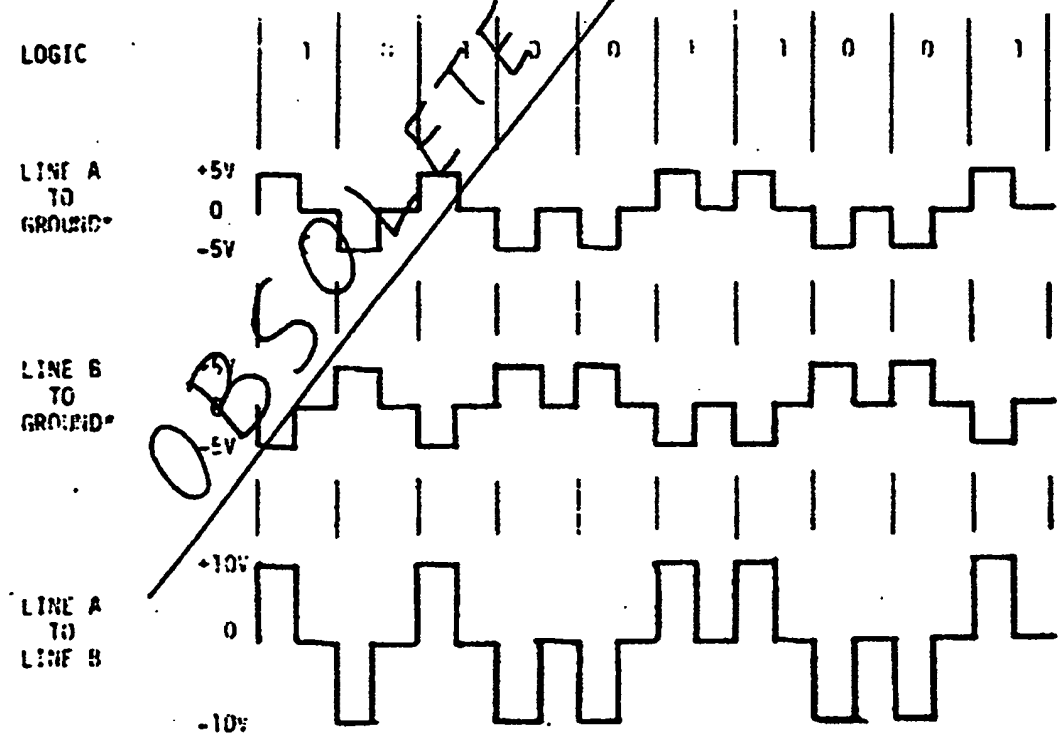
ORIGINAL TEXT:

ATTACHMENT 9-5
"AUXILIARY OUTPUT"
SIGNAL LOGIC LEVELS AND WAVEFORMS
(ARINC 429 BI-POLAR RZ CODE)

TABULATED VOLTAGES AND TOLERANCES

CIRCUIT	Transmitted Voltage						Received Voltage					
	ONE		ZERO		SYNC		ONE		ZERO		SYNC	
	NOM	TOL	NOM	TOL	NOM	TOL	NOM	TOL	NOM	TOL	NOM	TOL
Line A to Line B	+10	±1	-10	±1	0	±1	+10	±3	-10	±3	0	±3
Line A to Ground	+5	±0.5	-5	±0.5	0	±0.5	+5	±1.5	-5	±1.5	0	±1.5
Line B to Ground	-5	±0.5	+5	±0.5	0	±0.5	-5	±1.5	+5	±1.5	0	±1.5

OUTPUT LINE WAVEFORMS



OBSOLETE

NOTES:

1. "*" Indicates "Digital Signal Ground"
2. The "A" and "B" sides of each digital circuit (data and word sync) should use twisted and shielded cable with an insulating jacket. Neither side of the circuit should be grounded at any point in the aircraft interwiring or within the receiver device.
3.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 4

TO

ARINC CHARACTERISTIC 717

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

This draft dated: March 8, 1982

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: December 10, 1981

A. PURPOSE OF THIS SUPPLEMENT

This Supplement introduces pin reservations for additional input buses, assignment of aircraft identification codes and labeling of "H" and "C" for potentiometer excitation and accelerometer excitation.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and, where appropriate, extracts from the original text for comparison purposes. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "¢-4" symbols in the margins. Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-4 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition or change and, for other than very minor revisions, and text originally contained in the Characteristic is reproduced for reference.

ATTACHMENT 2-2 DFDAU STANDARD INTERWIRING

Designation for pin RMP14F (Potentiometer excitation) changed from "a" to "H".

Designation for pin RMP15F (Potentiometer excitation) changed from "c" to "C".

Pins RTP10E and RTP10F reserved for DITS input port no. 25.

Pins RTP10G and RTP10H reserved for DITS input port no. 26.

Pins RTP10 J and RTP10K reserved for DITS input port no. 27.

Pins RTP12A and RTP12B reserved for DITS input port no. 28.

ATTACHMENT 2-2 DFDAU STANDING INTERWIRING (cont'd)

Pins RTP12C and RTP12D reserved for DITS input port no. 29.

Pins RTP12E and RTP12F reserved for DITS input port no. 30.

Pins RTP12G and RTP12H reserved for DITS input port no. 31.

Pins RTP12J and RTP12K reserved for DITS input port no. 32.

ATTACHMENT 3-2 DFDAU PIN ASSIGNMENTS

"H" added to assignment for pin LMP14F.

"C" added to assignment for pin LMP15F.

"H" added to assignment for pin RMP14F.

"C" added to assignment for pin RMP15F.

Pins RTP10E and RTP10F reserved for DITS input port no. 25.

Pins RTP10G and RTP10H reserved for DITS input port no. 26.

Pins RTP10J and RTP10K reserved for DITS input port no. 27.

Pins RTP12A and RTP12B reserved for DITS input port no. 28.

Pins RTP12C and RTP12D reserved for DITS input port no. 29.

Pins RTP12E and RTP12F reserved for DITS input port no. 30.

Pins RTP12G and RTP12H reserved for DITS input port no. 31.

Pins RTP 12J and RTP12K reserved for DITS input port no. 32.

ATTACHMENT 5-4 IDENT DISCRETE ASSIGNMENTS

Additional aircraft codes assigned for A-310 and A-300.

Code 4 changed to P&W Engine.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 5 & 6
TO
ARINC CHARACTERISTIC 717
FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: December 14, 1985

Prepared by the Airlines Electronic Engineering Committee

Supplement 5 adopted by the Airlines Electronic Engineering Committee:
August 15, 1985

Supplement 6 adopted by the Airlines Electronic Engineering Committee:
November 8, 1985

A. PURPOSE OF THIS SUPPLEMENT

This Supplement deletes DC1 and DC2 pin assignments and identifies IDENT discrete assignments for ten aircraft types.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and, where appropriate, extracts from the original text for comparison purposes. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "¢ " symbols in the margins. Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-6 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition or change and, for other than very minor revisions, and text originally contained in the Characteristic is reproduced for reference.

ATTACHMENT 1 - SYSTEM BLOCK DIAGRAM

Data control connections deleted.

ATTACHMENT -2-1 - SYSTEM STANDARD INTER-WIRING

Data Control 1 and Data Control 2 assignments deleted.

ATTACHMENT 2-2 - DFDAU STANDARD INTER-WIRING

Pins RTP15G and RTP15H changed from Data Control 1/2 to "Spare".

ATTACHMENT 3-2 - DFDAU PIN ASSIGNMENTS

Pins RTP15G and RTP15H changed from Data Control 1/2 to "Spare".

ATTACHMENT 3-8 - CONTROL PANEL AND DATA ENTRY PANEL PIN ASSIGNMENT

Pins C and D changed from Data Control 1/2 to "Spare".

ATTACHMENT 5-4 - IDENT DISCRETE ASSIGNMENTS

Boeing 737-200, 737-300, Airbus A-310-300 series, Fokker F-28, Boeing 767-300 series and Airbus A-320-200 aircraft IDENT discrete assignments added.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 7

TO

ARINC CHARACTERISTIC 717

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: November 14, 1986

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: August 19, 1986

A. PURPOSE OF THIS SUPPLEMENT

This Supplement identifies IDENT discrete assignments for fifteen aircraft types and introduces optional use of the printer defined by ARINC Characteristic 740 and the multipurpose CDU defined by ARINC Characteristic 739.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and , where appropriate, extracts from the original text for comparison purposes. the second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "ȼ-7" symbols in the margins. Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-7 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition or change and, for other than very minor revisions, and text originally contained in the Characteristic is reproduced for reference.

1.4.5 Printer (Optional)

Commentary expanded to address ARINC Characteristic 740 Printer.

ORIGINAL TEXT FOLLOWS:

1.4.5 Printer (Optional)

A hard-copy printer to be used in conjunction with the DFDAU is an optional item. Pins have been reserved on the DFDAU connector to provide the interface connections needed for the printer.

COMMENTARY

Details for the printer are not given in this Characteristic, however, there has been interest in having a "standard" printer that may operate with various types of equipment (i.e., ACARS). It is the hope of the developers of ARINC 717 that the manufacturers of DEFDARS equipment will provide a printer interface (when requested) that will operate with such a "standard" printer.

1.4.5 Printer (Optional) (cont'd)

COMMENTARY (cont'd)

There has been some interest expressed for a separate printer spec. However, the level of interest at this time does not warrant the effort. The manufacturers are urged, in lieu of a printer spec, to make the printer interface compatible with that of ARINC 724 ACARS.

5.2.2 Document Data Input

Reference to ARINC Characteristic 739, "Multi-Purpose Control/Display Unit" added.

ORIGINAL TEXT FOLLOWS:

5.2.2 Document Data Input

Data entered onto the record from the FDEP is called documentary data and there should be one 12-bit word in each frame allotted for this data-in the same subframe as the frame counter (see Section 5.5.4).

The DFDAU should in this word continuously output the latest documentary data received from the FDEP.

COMMENTARY

Neither the data format nor the electrical format for the data exchange between DFDAU and FDEP are part of this Characteristic. One suggested organization of the data permitting a variety of information to be entered in the data word, assigns three BCD digits in each of several Documentary Data words and uses the Frame counter to identify the data.

8.0 Flight Data Entry Panel Design (FDEP)

Title revised to "Flight Data Entry Panel (FDEP) Design and Documentary Interface".

8.4 Alternative Means for Entering Documentary Data

New section added.

ATTACHMENT 1 - SYSTEM BLOCK DIAGRAM

Optional MCDU added to diagram.

ATTACHMENT 2-1 - SYSTEM STANDARD INTER-WIRING

Optional MCDU interface added to diagram.

ATTACHMENT 2-2 - DFDAU STANDARD INTER-WIRING

Pins RTP2C and RTP2D reserved for "MCDU/Printer Output". Pins RTP2E and RTP2F reserved for "MCDU Input". Pins RTP2G and RTP2H reserved for "Multiple Input Printer Input".

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401

SUPPLEMENT 8

TO

ARINC CHARACTERISTIC 717

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: January 15, 1988

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: January 6, 1988

A. PURPOSE OF THIS SUPPLEMENT

This Supplement identifies IDENT discrete assignments for two aircraft.

B. ORGANIZATION OF THIS SUPPLEMENT

The first part of this document, printed on buff-colored paper, contains descriptions of the changes introduced into the Characteristic by this Supplement, and, where appropriate, extracts from the original text for comparison purposes. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each replacement page is identified with "c-7" symbols in the margins. Existing copies of Characteristic 717 may be updated by simply inserting the replacement white pages where they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

Copies of the Characteristic bearing the number 717-8 already contain this Supplement and thus do not require revisions by the reader.

C. CHANGES TO CHARACTERISTIC 717 INTRO-DUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is entitled by the section number and title currently employed in the Characteristic, or by the section number and title that will be employed when the Supplement is eventually incorporated. In each case there is included a brief description of the addition or change and, for other than very minor revisions, and text originally contained in the Characteristic is reproduced for reference.

ATTACHMENT 5-4 - IDENT DISCRETE ASSIGN-MENTS

Two new aircraft IDENT discrete assignments added.

SUPPLEMENT 9

TO

ARINC CHARACTERISTIC 717©

FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: December 3, 1993

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: August 20, 1993

A. PURPOSE OF THIS SUPPLEMENT

This Supplement identifies new IDENT discrete assignments for aircraft types and assigns pins for interfaces to the Multi-Purpose Control/Display Unit (MCDU), the Data Loader and the Data Management Unit. Editorial changes have been made for consistency and improved readability.

B. ORGANIZATION OF THIS SUPPLEMENT

This document, printed on buff-colored paper, contains descriptions of changes introduced into Characteristic 171 by this Supplement. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each page is identified by a "¢-9" symbol in the margins. Existing copies of ARINC Characteristic 717-8 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted inside the rear cover of the Characteristic.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is defined by the section number and the title currently employed in the Characteristic or by the section name and title that will be employed when the Supplement is eventually incorporated. In each case a brief description of the change or addition is included.

1.2.1 Relationship to ARINC Characteristic 573

Grammatical corrections were made to enhance readability.

1.6 Interchangeability

Commentary was changed to replace "DITS" with "ARINC 429", as ARINC 429 is the preferred nomenclature.

Grammatical corrections were made to enhance readability.

References to ARINC Report 403 and ARINC Report 414 were deleted as these documents are obsolete.

1.7 Regulatory Approval

References to ARINC Report 414 were deleted as this document is obsolete.

2.2.1.1 Form Factor

The reference to "NIC Phase 1" was deleted because this phase has been completed.

3.10 Failure Warning and Function Test

The reference to ARINC Report 415 is removed due to the obsolete status of that document. ARINC Report 604, "Guidance for Design and Use of Built-In Test Equipment (BITE)" describes users' desires for functional test.

4.1.4 Standard "Applied Voltage"

References to ARINC Specification 410 were deleted, as this Specification is no longer held in inventory.

4.3 Digital Data Inputs

Text was changed to replace "DITS" with "ARINC 429", as ARINC 429 is the preferred nomenclature.

4.3.1 Cabled Aircraft Data

Text was changed to replace "DITS" with "ARINC 429" as ARINC 429 is the preferred nomenclature.

4.3.5 Bus Fault Protection

Text was changed to replace "DITS" with "ARINC 429" as ARINC 429 is the preferred nomenclature.

5.2.2 Documentary Data Input

This section was revised to insert text that was inadvertently omitted.

ATTACHMENT 2-2 AND 3-2 - STANDARD INTERWIRING AND PIN ASSIGNMENTS

The following pins have been assigned.

RTP2F	MCDU #1	Input - A
RTP2F	MCDU #1	Input - B
RTP2J	MCDU #2	Input - A
RTP2K	MCDU #2	Input - B
RMP5H	Optional Data #2	Output - A
RMP6H	Optional Data #2	Output - B
RMP7H	Data Ldr	Input - A
RMP8H	Data Ldr	Input - B
RMP9H	Data Ldr	Output - A
RMP10H	Data Ldr	Output - B
RMP11H	Data Ldr	Enable Discrete

ATTACHMENT 5-4 - IDENT DISCRETE ASSIGNMENTS

Twenty Three new aircraft IDENT discrete assignments added.

AERONAUTICAL RADIO, INC.
2551 Riva Road
Annapolis, Maryland 21401-7465 USA

SUPPLEMENT 10
TO
ARINC CHARACTERISTIC 717
FLIGHT DATA ACQUISITION AND RECORDING SYSTEM

Published: January 15, 1997

Prepared by the Airlines Electronic Engineering Committee

Adopted by the Airlines Electronic Engineering Committee: October 24, 1996

A. PURPOSE OF THIS SUPPLEMENT

This Supplement identifies new ident discrete assignments for aircraft types and provides for increased data transfer rates.

B. ORGANIZATION OF THIS DOCUMENT

This document, printed on buff-colored paper, contains descriptions of changes introduced into Characteristic 717 by this Supplement. The second part consists of replacement white pages for the Characteristic, modified to reflect these changes. The modified and added material on each page is identified by a C-10 symbol in the margins. Existing copies of ARINC Characteristic 717-9 may be updated by simply inserting the replacement white pages where necessary and destroying the pages they replace. The buff-colored pages should be inserted in the rear cover of the Characteristic.

C. CHANGES TO CHARACTERISTIC 717 INTRODUCED BY THIS SUPPLEMENT

This section presents a complete tabulation of the changes and additions to the Characteristic introduced by this Supplement. Each change or addition is defined by the section number and the title currently employed in the Characteristic or by the section name and title that will be employed when the Supplement is eventually incorporated. In each case a brief description of the change or addition is included.

Section 4.4.6 - Ident Inputs

An additional pin assigned for Aircraft Type Ident.

Section 5.3.1.1 - Frame Structure

Provisions for data rates of 128, 256 and 512 words per second described.

Section 5.3.2 - DFDR Output Data Bus

Data rates of 128, 256 and 512 words per second added.

ATTACHMENT 2-2 - DFDAU STANDARD INTERWIRING

Pin RTP11J assigned to "Aircraft Type Ident".

ATTACHMENT 3-2 - DFDAU PIN ASSIGNMENT

Pin RTP11J assigned to "Aircraft Type Ident".

ATTACHMENT 5-3 - SUMMARY OF DISCRETE INPUT ASSIGNMENTS

Pin RTP11J assigned to "Aircraft Type Ident 64 - discrete #100".

ATTACHMENT 5-4 - IDENT DISCRETE ASSIGNMENTS

Five new aircraft type ident discrete assignments added. Table expanded to include discrete #100.

ATTACHMENT 9-2 - DIGITAL DATA WAVEFORMS

Rise and fall times added for 128, 256 and 512 words per second.

Key Differences

Ross 5,351,194	Harris/Grabowsky 6,181,990
Apparatus and Method for Closing Flight Plans and Locating Aircraft	*Aircraft Flight Data Acqusition and Transmission System*
Real-Time Data	Stored In-Flight Data
Airborne Transmission	Ground Transmission Only
Tracking & Locating	Full Flight Performance Data
On Ground "Cancels Flight Plan" or Crash On Ground Sends Location & ID	Ground Transmission includes flight data gathered in-flight and Time, Airspeed, Altitude, Vertical Acceleration and Heading Data

EXHIBIT 2